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IT is an easy matter for a common council to pass a smoke ordinance, prohibiting the production of smoke. But if we are to believe the report of the committee and the discussion on the prevention of smoke at roundhouses and terminal,s it is quite another, if not impossible, matter to live up to these requirements. People who know nothing about this matter have been prolific inventors of smoke preventatives for years. The man who does not have to deal with the problem always knows exactly what the man who does have to deal with it ought to do. But the man who builds the fire in a locomotive and those responsible for the whole subsequent train of events, are absolutely at a loss as to how to stop smoke production. There are numerous suggestions as to how the production might be reduced, but none as to how it could be prevented. The spectacle is similar to those presented by numerous other attempts at railway regulation. A municipal council of uninformed politicians decrees that the railway locomotives and roundhouses shall emit no smoke, and the august convention of the American Railway Master Mechanics' Association says that it knows of no means by which the requirement can be met. We all know that the way to prevent the bagging of trousers at the knee is not to wear the trousers. So to prevent smoke in roundhouses and terminals, don t build fires in the fire-boxes. Certainly, an easy remedy to apply or not to apply, and, according to the discussion of yesterday, apparently the only one which, if applied, will be at all efficacious.

MR. FULLER'S suggestion that more attention should be given to the education of apprentices is a splendid one. The M. M. Association now has a code of apprenticeship rules which was revised in 1908. It covers the general or basic principles of modern apprenticeship and possibly needs revision again. The difficulty is that its application thus far has been to large systems such as the New York Central and the Santa Fe. Both of these systems have strong central organizations in charge of the department which are in the hands of capable men who give all their time and energies to the development and supervision of the work. This system is not feasible on the smaller roads and it is extremely desirable that more information should be available as to just how these principles may be applied to the best advantage in such cases. It is quite possible under these circumstances that the standard rules may have to be considerably modified. The important thing is that the apprentices should be given individual instruction in both the theory and practice of their trades and that this be done during working hours while the boys are under pay. The association could accomplish much good by having available in its proceedings a full record of the various methods which are giving good results on roads both small and large and in various parts of the country, for an apprentice system to be a success must be specially suited to the class of boys it is intended to develop.

ONE of the notable features of the discussion on mechanical stokers yesterday morning, was in the general attitude of the convention on the subject and the marked change in this attitude, as compared with a year ago. At that time, and for several years previous, there had been a groping for information, an air of expectancy and hopefulness that something would be developed that would be productive of satisfactory results, coupled with an air of disappointment that the results obtained had been so meagre, and an underlying dissatisfaction with existing stoker conditions. It is interesting, then, to note the great advances that have been made during the past year. The situation seems to have cleared. Men who were skeptical then admit a change of opinion, and are now supporters of the stoker. Experience tells of success in maintaining steam pressure, of the cutting down of coal consumption until hand firing is bettered, of the reduction in smoke consumption and the apparent seating in the saddle of at least three stokers that can be relied on for efficient and economical work. The bugaboo of excessive coal consumption has disappeared, and the stoker is looked upon as a means of not only relieving the fireman of the main burden of his physical exertion, but of adding to the efficiency of the locomotive by increasing the work that it can do. The strength of the fireman has, heretofore, put the limit on the work of the engine. With this limit removed, the engine is to be required to do more than it has ever done before. In short, the report and the attitude of all who took part in the discussion, accepted the stoker as an accomplished fact; not an achievement on which "finished" can be written, for the development is not yet at an end, but one on which such a dependence can be placed that for those who wish to reduce the work of the fireman or increase the amount of work done by the locomotive, such a means is at hand if they

choose to use it. As to the details of what the stoker should do, there are still differences of opinion, but these are of minor importance compared with the general acknowledgment of stoker efficiency that has been made. The locomotive stoker seems, at last, to be coming into its own, and unless the indications are very misleading, the probabilities are that the comments on the subject a year hence will include a statement of a wide application of these machines to the heavy locomotives of the country.

PROBABLY the most valuable part of the report on mechanical stokers for locomotives is the recommended specification which defines the various requirements which automatic stokers should fulfill. These are stated briefly, and should be further elaborated, as they will have an important influence on the future development of the stoker. One item requires that the stoker should be mechanical from tender to grate, which implies a conveyor to relieve the fireman from handling coal. While in the discussion some thought this too radical a provision and not entirely necessary, the general opinion was that the conveyor should form an essential part of a locomotive stoker, and as several are already in successful operation, it cannot be regarded as a hardship to make this a definite requirement in the stoker specification. The fifth item requires that the stoker shall "distribute the coal over the grate in such a manner as to call for no assistance from the fireman other than regulation of supply, and possibly the adjustment of the mechanical appliances for distribution." This paragraph is not entirely clear and should be revised. It seems to imply that the stoker has been so fully developed that the distribution is automatic and requires scarcely any attention on the part of the fireman. It was shown in the discussion that one of the principal difficulties with some stokers is that they bank the coal, which means irregular distribution over the grate. It can hardly be expected that this be entirely accomplished mechanically and automatically under varying conditions of draft, speed and track, and it is not too much to require that the fireman shall take an active part in the portion of the work of maintaining an even fire. It is best that he should, and that the responsibility for coal distribution on the grate be divided between the machine stoker and the fireman. There will then be less waste of fuel and a greater certainty of maintaining full boiler pressure.

PRESIDENT FULLER called attention forcibly, in his address yesterday, to the need for greater uniformity in legislation affecting railway operation, and also in the practice of the various railways themselves. Until a short time ago railway legislation was almost entirely restricted to the regulation of traffic. The original safety appliance law was in effect, but it left the railways much latitude as to standards and practice. Recently, however, the law makers, both in Congress and the state legislatures, have begun industriously to regulate matters concerning all the branches of the operating department, including the mechanical. The result is both federal and state laws regarding these matters, which commonly make different, and often conflicting requirements. The recent decision of the United States circuit court in the Minnesota case clearly holds that where state laws and federal laws regulating railways conflict, the former must yield. As Mr. Fuller indicated, federal is generally preferable to state regulation. The railways can obey one master; they cannot obey over 40 masters if they give different orders; and experience has shown that the states will make different requirements from each other and from the federal government. It is greatly to be hoped, therefore, that this decision will be upheld by the United States supreme court. Uniform practice by the railways themselves is hardly, if at all, secondary in importance to uniformity in the legislation regulating them. The mistake sometimes has been made by various railway associations of adopting as standard practices and devices which had not been, and which were not subsequently, accepted and used with any approach to unanimity by the individual lines. This has got the roads in many difficulties. When anything is adopted by a railway association such as the Master Mechanics' or the Master Car Builders', the public and the law makers are going to assume, naturally, that the practice recommended is the best practice. So assuming, they will naturally condemn any railways which do not use the recommended standards and are apt to pass laws to require all to use them or to impose still more stringent requirements. It seems beyond question that it is expedient for the roads, first, to be conservative and painstaking in adopting standards, and then to make their practice as nearly uniform as the widely varying conditions in this big country will permit. The public and the regulating authorities look upon the railways as a single system; and in order to deal effectively with public opinion and the regulating powers, the railways must, to a very large extent, deal as a unit with them. It is generally conceded that no body of men ever did more effective or salutary work for the railways than the Special Committee on the Relations of Railway Operation to Legislation has done during recent months; and its effectiveness has been mainly due to the fact that it has exercised a strong influence to bring about uniform practice by the various lines it has represented, and in dealing with public authorities has been able to speak for its constituent lines as a whole. The mechanical officers should be especially able to appreciate the work that this committee has done, because the good results it has obtained have been largely in connection with the safety appliance standards adopted by the Interstate Commerce Commission and the locomotive boiler inspection law recently passed by Congress. As Mr. Fuller indicated, experience should have taught to railway officers the lesson in the words "United we stand; divided we fall," so that they will not soon forget it.

PRESIDENT FULLER ON RAILROAD EFFICIENCY.

PRESIDENT FULLER in his address referred to the remarkable vogue that the subject of railway efficiency has had during recent months. Until recently hardly anybody in the United States would have questioned that the railways of this country were one of its most efficiently managed industries, if not its very most efficiently managed. Then Mr. Brandeis asserted before the Interstate Commerce Commission that by scientific management they could save $1,000,000 a day, and put on the witness stand a number of men who had been employed by railways to promote efficiency to testify that there was almost no such thing; and immediately every anti-railway agitator in public life and every muck-raking newspaper and magazine writer discovered how disgracefully incompetent railway managers are; and they have been talking and writing about it ever since. Mr. Fuller's able chief, J. Kruttschnitt, in his recent lecture on "The Efficiency of Railway Service," at Harvard University, and other railway officers in public utterances, have now, by giving the facts, convinced a large part of the public that railway managers and management are not so incapable as they have been painted; and it is possible to discuss the subject somewhat more intelligently and dispassionately.

The facts of the matter, briefly stated, are, first, that there has been a great increase in the economy and efficiency of management during the past ten years, and that the railways, as a whole, probably are the best managed concerns in the country; and, second, that there is plenty of room for very important additional increases in economy and efficiency. As a very prominent railway president said recently: "Of course, we can save $1,000,000 a day; we have done it, and can do it again if the public will give us time and opportunity; but we can't do it while you mop your brow." It is the very purpose of such conventions as are being held in Atlantic City to save that $1,000,000 a day, and more, too, if possible; and if the critics of the railways knew a little more about the

splendid work that has been and is being done by the Master Mechanics' and Master Car Builders' Associations, the American Railway Engineering Association, the Signal Association and numerous other organizations of railway operating officers, they would take a very different view of railway management.

There is one point, however, in which the *Railway Age Gazette* believes the various railway operating and technical organizations, including the M. M. and M. C. B. Associations, have been and are remiss. Sixty per cent. of the expenditures of the railways are for labor; the problem of getting the best results from these expenditures is one of the greatest that confronts railway managers; and yet the various leading associations give hardly any attention worth mention to it. The best methods of handling all classes of workmen employed in the mechanical department ought to be prominently considered at these conventions every year; and yet they are hardly considered at all. The cold fact of the matter is, that railway officers are afraid of the labor problem. The labor leaders have most of the operating executives so completely whipped that they entirely lack the courage to discuss wages and conditions of employment in public, except in the most general terms; and naturally other officers are loath to rush in where their superiors fear to tread. But the question of the proper relations between the railways and their employees, whether in the mechanical or any other department, will never be solved by whispering about it in a corner. The facts about the existing relations must first be made as public as any other facts about the railway business, and then they must be dispassionately studied and fearlessly discussed. These are necessary preliminaries to the solution of the labor problem on the railways; and they will serve to make its solution easier. Without them its satisfactory solution will be impossible.

LOCOMOTIVE FRAMES.

THE report on locomotive frames indicates that we are making little progress in preventing the breakage of frames. They continue to fail in about the same proportion as in years past. One road reports that as many as 39 per cent. of the engines passing through its shops have broken frames. The failures appear to be progressive, increasing with the time of service of the engine, indicating that, after frames which are defective have been eliminated, good frames will break in time with a clean, solid fracture due to constant bending action. As might be expected, the failures are more frequent with long locomotives such as consolidations and decapods. This seems to indicate that what is needed in these long frames is a more uniform flexibility; as splices add to local stiffness the fewer splices there are the more flexible the frames will be. The committee therefore recommends the type of frame which dispenses with splices as far as possible.

As a result of the study of European practice the committee concludes that there is no advantage in plate frames for American locomotives, but it is interesting to find that the Baldwin Locomotive Works has used plate frames with angle iron flanges for the new electric freight locomotives of the New Haven road. These engines will develop a greater horse power than any single steam unit built heretofore, but the electric engines are not subject to the stresses due to the reciprocating action of pistons and crossheads.

The report finds that there is a general agreement that cast steel is superior to forged wrought iron frames, not only on account of the difficulty in welding up the latter, but because cast steel is stronger than wrought iron. The specification for the steel castings submitted to the association in 1904 is not adapted to obtain a very strong casting; the material is much like soft rolled steel in its composition, having 0.28 carbon and a minimum tensile strength of 55,000 lbs. A much stronger casting would be obtained if the tensile strength requirement were increased to 75,000 or 80,000 lbs. and the carbon to 0.45 or 0.50. The principal objection to such material would be made by the locomotive builders, as it would be harder to plane and slot, but the material would have much greater strength, and that seems to be what is required to resist the heavy stresses to which locomotive frames are subjected. In the use of a hard and strong steel for locomotive frames it would be necessary to round all the corners, have ample fillets and not allow any sharp edges, as this is liable to start small cracks which gradually develop into larger ones which finally produce fracture.

It is strange that advantage has not been more frequently taken of efficient sections like the I-beam for cast steel frames, for it is easily possible to obtain such shapes in cast metal, but the prevailing practice is similar to that for wrought iron in using rectangular sections. Mathematical formulæ are of little use in designing frames except as a mere matter of making sections proportional to maximum thrust and factors based on extended practice, and the committee wisely recognizes this fact by including in the report only very simple formulæ for such calculations.

GIVING MECHANICAL STOKERS A FAIR CHANCE.

THERE is a curious inconsistency in the attitude that railway officials are assuming towards the mechanical stoker for locomotives. They admit the desirability of the machine on heavy locomotives and certainly they have been most lavish in the opportunities which they have given to designers to develop their ideas in practical service; and when these designs have been worked out, orders have been given to place them on locomotives for regular work. But there the interest ceases. It is then that there seems to be a total forgetfulness of all past experience and practice. They seem to think that the stoker is endowed with some supernatural power, or the fireman with a superhuman intelligence that will produce results regardless of all adverse conditions. It is apparently a matter of no moment that everyone, designers, roundhouse foremen, traveling engineers, engineers, and firemen are agreed that the stoker should have fine coal to work with. Fine coal will be furnished if convenient, and if not, on goes lump and an engine failure is attributed to a defective stoker.

For years there has been a systematic training of the fireman for hand firing. His intelligence and knowledge of the locomotive is carefully scrutinized before he is given a through run. Yet he is called in turn, assigned to an engine, and learns when he climbs aboard, to leave the roundhouse, that the engine is equipped with a stoker. He knows nothing about it. His engineman is equally ignorant, and his only chance to get posted lies in the few minutes between leaving the house and taking his train. Of course, the stoker does not do well and he can thank his lucky stars and innate brightness if he does not have a failure.

Why, then, not follow past practice and precedent? Why not teach the men the use of a machine just as they are taught the other parts of the locomotive? Surely the experience with the air brake is a case in point. The same process was followed there. Men were given trains to handle with air, without instruction or training, with the result that after break-in-twos and "failure of the air brake" had become almost epidemic the upper officers came to a realizing sense that the trouble was with them and not with the men, because they were expecting impossibilities. They were expecting men to do by instinct what they could only do after experience and training. So the air brake instruction car was established, and now there is no official so foolish as to expect an engineer to handle his air properly until he has had a course of instruction.

Why, then, not use this past experience and apply it to the stoker? It acts differently from hand work. It acts differently with different kinds of coal, with different weights of train, on

different grades, and through the whole gamut of possible variations in the demands on the firebox. So why not give a man an instruction that will at least put him in a position to have some faint inkling of what he is expected to do, and what the machine can do for him?

Again, experience has taught us that a roundhouse force is necessary at every division point to make running repairs to the locomotives; and not only the locomotive but the appurtenances connected therewith. The engine is inspected, the air brakes are tested, and the boiler is looked after with the tenderest care. But the stoker? Oh, that's all right. That will take care of itself. It is a matter of no importance whether its engine is lubricated or not. It should need no attention. Doesn't the fireman wash and feed and take care of himself? Surely a stoker that is to take his place must do as much as that, and if it fails then it is a failure as a stoker.

There is just this to be learned and practiced. A stoker is a machine. It needs the same attention that any other machine will need if it is to be kept in proper working trim. And until the upper officials wake up to the fact that a stoker needs all of this; that it must be inspected, cared for and repaired; that it must be kept in first class condition; that it must be furnished coal it can handle; that the men who operate it must be instructed in its use; and that it will wear out and deteriorate like other machines, general satisfaction in its operation must not be expected.

Was there ever such a trite set of platitudes as the above, printed in any paper before? Certainly there would have been great hesitation in printing them here, had not personal investigation found them to exist in all their—shall we say—flagrancy.

TO-DAY'S PROGRAM.

M. M. ASSOCIATION.

Discussion of reports on—	
Main and Side Rods	9.30 A. M. to 10.00 A. M.
Piston Rods and Cross Heads.	10.00 A. M. to 10.30 A. M.
Repair Equipment for Roundhouse.	10.30 A. M. to 11.00 A. M.
Water Treatment	11.00 A. M. to 11.30 A. M.
Lubrication of Locomotive Cylinders	11.30 A. M. to 12.00 M.
Consolidation	12.00 M. to 12.30 P. M.
Individual Paper on "Superheat," by Prof. C. H. Benjamin.....	12.30 P. M. to 1.00 P. M.
Safety Valves	1.00 P. M. to 1.30 P. M.

Adjournment.

ENTERTAINMENT.

Band Concert, 10.30 A. M.—Entrance Hall, Million Dollar Pier.

Band Concert, 3.30 P. M.—Entrance Hall, Million Dollar Pier.

44th Annual Ball, 9.30 P. M.—Of the American Railway Master Mechanics' Association, Entrance Hall, Million Dollar Pier. (Vollmer's Orchestra.)

The Galena Signal Oil Company's booth will be used as a rest room for the officers and their guests.

MASTER MECHANICS' BALL TO-NIGHT.

The forty-fourth annual ball of the Master Mechanics' Association will be given on the Million Dollar Pier at 9.30 to-night. Headquarters for the officers of the association will be established during the evening in the booth of the Galena-Signal Oil Company at the east (ocean) end of the ball room, and the line of march will be formed in front of this booth. The grand march will be led by President and Mrs. Fuller and other officers of the M. M. and M. C. B. associations and their ladies, and will be personally conducted by J. Will Johnson, chairman of the entertainment committee.

An interesting feature is the scheme that has been adopted to enable dancers to find their partners. Twelve stations called by the names of twelve cities, and indicated by signs, will be in different parts of the ball room; and opposite the musical selections on the dance program are blank spaces on which dancers may enter the names of the stations at which they will meet their partners for the various dances.

Vollmer's Orchestra will furnish the music, and there will be 19 regular dances. Punch, lemonade and ice water will be served from tables at both the east and west ends of the ball room.

TRANSPORTATION FOR RETURN RAILWAY TRIPS.

Secretary Taylor yesterday read the following communication from the Pennsylvania Lines:

"Kindly notify the railway members of the Master Car Builders and Master Mechanics Associations wishing transportation home over the lines of the Pennsylvania Railroad Company or the Pennsylvania lines West of Pittsburgh that such transportation will be provided if they hand you their names. Owing to the requirements of the law this transportation must be limited to bona fide railway officials only, and cannot include members of belt lines, car lines, or switching roads operated by industries."

Members wishing to avail themselves of this transportation will present their credentials to the secretary and he will see that they have their transportation arranged by Friday morning.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.

In accordance with section 4 of article IV of the by-laws of the above association, the executive committee by proclamation has named the hours between 10 A. M. and 12 M., Friday, June 16, for the election of members of the executive committee, and ballot boxes will be open between the above hours to receive votes for members of the executive committee from the districts.

This election shall be held in the office of the executive committee, uptown side of the Million Dollar Pier, next to the enrollment booth.

Members are to be elected from the following districts:

Third District—Pennsylvania, Maryland, Delaware, District of Columbia, West Virginia, two members in place of E. M. Grove, McConway & Torley Company, Pittsburgh, Pa., and B. E. D. Stafford, Flannery Bolt Company, Pittsburgh, Pa.

Fifth District—Illinois, Wisconsin, Iowa, Minnesota, one member in place of L. R. Phillips, National Tube Company, Chicago, Ill.

Sixth District—Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, one member in place of A. C. Langston, Jenkins Brothers, Atlanta, Ga.

Election will be by ballot. A separate ballot box will be provided for each of the above districts. Official blank ballots will be provided. Ballots may be cast at any time between 10 A. M. and 12 M., on the date above mentioned.

One vote only shall be cast by each member, corporation, copartnership, or individual; same to be cast only by the properly accredited delegate of such member.

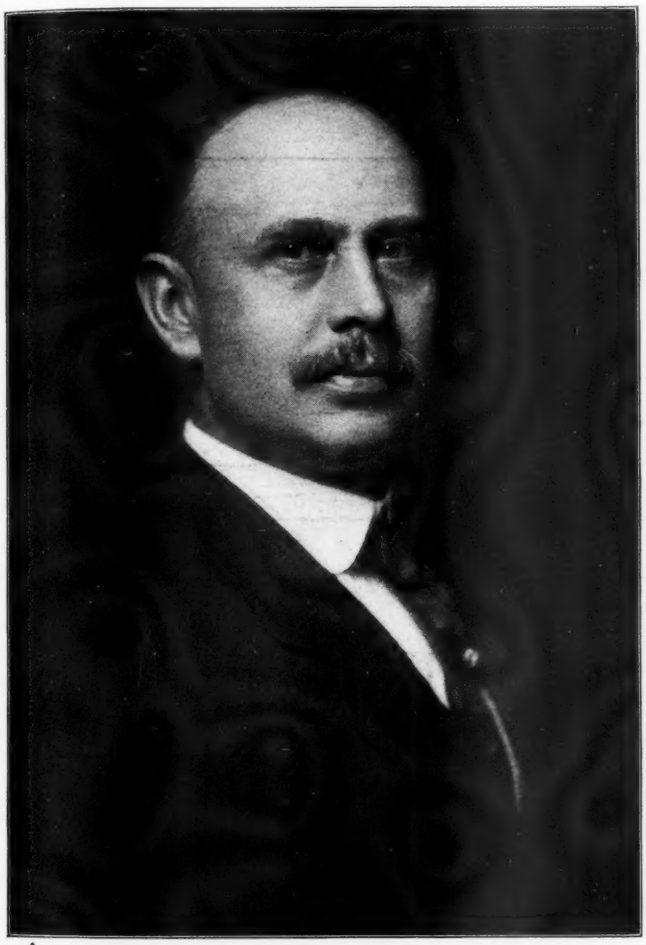
Each voting delegate shall deposit his ballot in the ballot box marked for the district within which the home office of his company is located. Every voting delegate should see that the person for whom he votes for executive member is a resident of the district in which he votes, and is a representative of a member of the association.

THE EXECUTIVE COMMITTEE.
J. D. Conway, Secretary.

Proceedings.

The first session of the forty-fourth annual meeting of the American Railway Master Mechanics' Association was held on June 14. President C. E. Fuller (U. P.), called the meeting to order at 9.30 A. M. The president, past presidents and members of the executive committee of the Master Mechanics' Association and also of the Master Car Builders' Association took chairs on the platform. Rev. Newton W. Cadwell, pastor of the Olivet Presbyterian Church of Atlantic City, opened the exercises with prayer.

Mayor Franklin P. Stoy welcomed the convention to Atlantic City.



C. E. Fuller.

President, M. M. Association.

H. T. Bentley (C. & N. W.), first vice-president, responded to the mayor's welcome.

ADDRESS OF PRESIDENT FULLER.

On this, the occasion of the opening exercises of the forty-fourth annual convention of the American Railway Master Mechanics' Association, it is my privilege and sincere pleasure to extend to you a hearty welcome. It is an especial pleasure that we are permitted to gather for the sixth time in this beautiful spot, so happily called the "Venice of America." Its hospitality has been proven and has left only the most pleasant recollections.

I will not take up your time in dwelling upon the work of the association in the past, but will confine my remarks to the events of the year and to some of the problems which confront us.

The American Railway Master Mechanics' Association stands for progress, as evidenced by its growth and accomplishments since its inception; and at our annual conventions, or birthday celebrations as we might call them, we review the work of the past and look forward to the future with brighter hopes and renewed vigor.

The year 1910-1911 has been a memorable one in so far as it relates to government legislation affecting the railways in general, and the mechanical department in particular. During this period federal laws have been enacted regulating safety appliances for railway equipment; also laws regulating the inspection and care of locomotive boilers. In some states there has been additional legislation, the full crew and caboose bills and headlight bills, while in addition to the federal legislation there has been in some parts of the east state legislation with regard to boiler inspection. In view of the federal and state legislation on the same matters, it would seem every possible effort should be made to have the state laws either withdrawn or amended to agree with the government legislation.

H. T. Bentley.

First Vice-President, M. M. Association.

In the matter of safety appliances your committee, in conjunction with the Master Car Builders' Association, has had this work in hand and has given a great deal of time to it, conferring with the government officials as well as representatives of the railway employees, and a set of rules was formulated covering the requirements.

In my opinion this association should insist on the Interstate Commerce Commission furnishing necessary drawings specifying in detail the location for safety appliances.

Your committee also gave considerable time and work to the boiler bill, and in conference with the government officials arrived at rules governing the same.

As the work of your special committee on the Safety Appliance and Boiler bills has now been completed and as both of these have to do exclusively with technical matters which can properly be handled by mechanical men, it would seem the future work in connection with these matters should be taken over by the association, and I would recommend the appointment of a committee to handle it. In this connection I cannot too strongly recommend that the members of this association conform promptly to the requirements of the Safety Appliance and Boiler bills, which

will indicate to the commission that the railways of America are ready to comply with the law if the requirements are clearly known.

It also appears to me that the requirements of the Safety Appliance act as well as the Boiler bill should be embodied in and adopted as the standards of this association.

In view of past legislation on matters pertaining particularly to the mechanical department, it would seem to me that the policy and work of this association should be more clearly outlined than ever before.

Our experience emphasizes the necessity for looking forward and taking such steps toward uniformity as will enable this association to take the initiative in these matters. I believe this is an opportune time for members of the association to get away from a great many of their personal opinions and get together and agree on the best standards and practices to a greater extent than ever before, and having arrived at such standards they should be followed. Uniformity and Unity should be the keynote of our future endeavors. The present conditions, so far as railway operation is concerned, have brought out in the columns of the various technical journals and elsewhere the thoughts of many master minds; and, while the trend of my remarks may not be along entirely original lines, I have selected such thoughts as seem to me to be the most pertinent to our needs.

In reviewing these articles and considering the situation and problems to be met, the small word "Unity" stands out above all others. Unity is the strength and support of any organization. The framers of the constitution of the great country realized it as we must realize it. We talk of scientific management and efficiency, but we must remember that there is nothing truer than that much quoted but golden sentence, "United we stand; divided we fall." Unity means harmony and coöperation, and by united effort will the desired results be obtained.

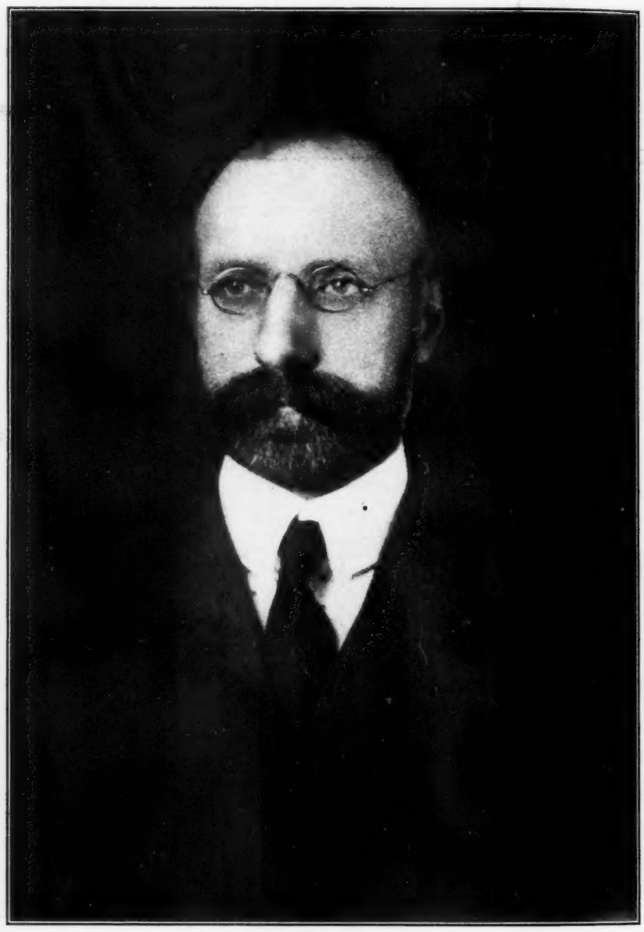
With united strength we can lead, not follow. This association stands alone and unique—the strongest mechanical organization in the world; yet our work is not being felt as it should be felt, owing to the fact that some of the individual members do not follow and carry out the recommendations of the association. This association for years has had committees on the most important matters and the work should not become lost or buried.

It is not my intention to criticize, and I hope my remarks will not be so taken as this is far from my thought or purpose, but I am very much afraid that our work is to a certain extent lost sight of, due to the fact, that the association has not taken advantage as it should of that which has been done, and has not adopted recommended practices nor have such practices been printed in the proceedings, as they should be from year to year.

Recent discussion and events have brought rather promi-

D. F. Crawford.

Second Vice-President, M. M. Association.



T. Rumney,

Third Vice-President, M. M. Association.

nently to public view the question of efficiency and economy in railway operation, but it is far from a new subject so far as those engaged in railway work are concerned. As railway officials, efficiency and economy have been our constant watchwords. Much has been done. The installation of the most modern rolling stock and shop equipment has brought about greatly increased efficiency in railway operation. The commercial feature of our operations has been watched with cnsequent increased efficiency in shop management.

Publicity has not until recent years entered very largely into railway operations and the public has not been fully informed of the efforts and accomplishments of the railways along the lines of efficiency and economy. Railways have a very deep interest in having the public correctly understand the achievements which have been made. Every published statement reflecting credit on the railways whether relating to their good intentions or their able management strengthens them in the public esteem and tends to promote a calm and wise solution of the problems of

governmental regulation. There is among us no disposition to evade discussion of our efficiency.

So far as the mechanical department is concerned, our efforts have not been sufficiently brought to the light of public recognition. We have been content with the satisfaction which comes from appreciation expressed by those best in position to judge. The operation of American railways has been praised by the highest authorities abroad as the most efficient and economical in the world. We have spent our lives in learning all we could from any quarter whatsoever which might be useful in promoting efficiency and increasing economy.

What is the purpose and significance of this convention? This is the fourty-fourth annual meeting of the American Railway Master Mechanics' Association. During a span of nearly half a century the railway companies of this country have delegated the responsible heads of their mechanical departments to attend these annual meetings. Here each of us in turn gives his best thought and the result of his own experience to the others. Here the standard of efficiency and economy in the performance of every function incident to the manufacture and maintenance of cars and locomotives has been advanced by comparison of experience and of views. Here we have had the suggestions of men not our members. It has mattered not to us what was the source of help.

The public should know that of all the enterprises of the country no other approaches the railways in systematic and persistent study of efficiency and economy.

In addition to this mechanical organization the officials connected with the maintenance of way have their engineering association which meets annually and whose purposes are similar to ours. Our foremen of the various branches of the work have their organizations meeting annually to exchange ideas and improve the efficiency of their members.

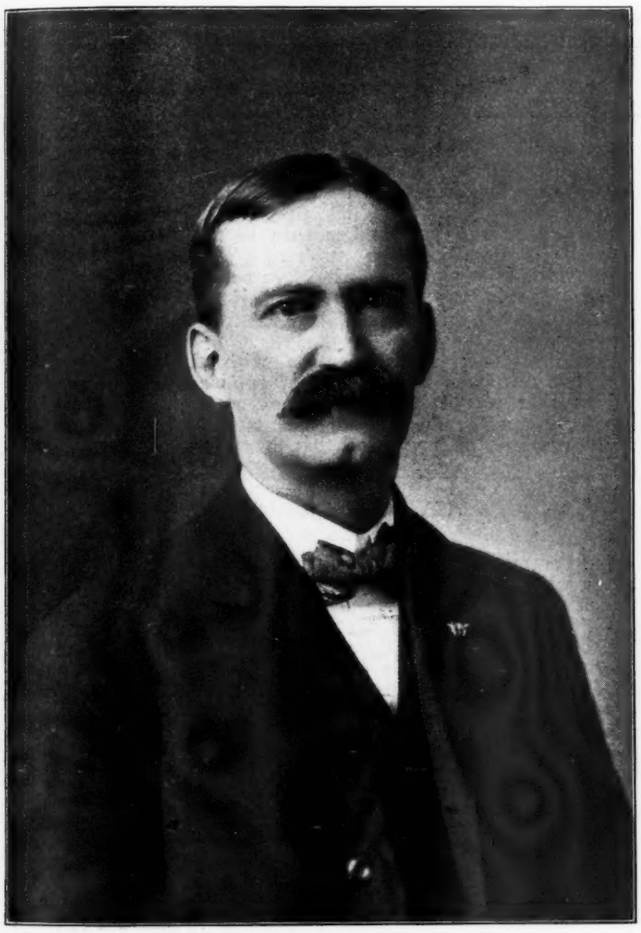
The entire territory of the United States is divided into sections, each having its territorial railway clubs and organizations for the furtherance of research and efficiency along specific lines. The existence of these organizations comprising the efficient managers and department heads of the railways, all endeavoring to systematize and improve operating methods is cited simply as additional evidence of what the railways are doing to bring about improved methods and increased efficiency.

From the foregoing you will readily appreciate there is very much that the American Railway Master Mechanics' Association can do along the lines indicated.

I see no reason why this association should not have as a part of its recommended practices, mechanical plans for large and small terminals, units embodying the best practices, so that if conditions are such that these plans in their entirety are not feasible or practicable it will be possible to take therefrom the best available features under which shop lay-outs can be designed. There are a good many of the railways that do not employ large and expensive engineering forces and such plans would be of infinite value to such members.

A very pertinent subject in connection with the matter of increased efficiency, to my mind, is the education of our apprentices, in fact of all our employees. By what better method can we hope to increase our efficiency than by setting a high standard for the young men we are educating, from whom we must be able to draw our foremen and shop managers? Progress has been made by some of the individual lines not only in the way of educating apprentices, but also giving other employes similar advantages by instituting plans of broad scope with educational bureaus open to all employees. It is my opinion that in line with these efforts our association should adopt a recommended apprentice system for apprentices to the various trades as well as for the technical graduates, commonly called "special apprentices."

On the recommendation of my predecessor a committee was appointed in connection with the establishment



J. W. Taylor.

Secretary, M. M. Association.

Angus Sinclair.

Treasurer, M. M. Association.

of a permanent technical bureau within our association. Such a bureau cannot help but be a valuable asset of this association and I cannot too strongly endorse the wisdom of this plan, which I hope will be carried out at an early day. I have indicated the work which has been accomplished by the special committee which conferred with the government officials in the matter of safety appliances and the boiler bill. This simply illustrates what can be done and the value of a centralized bureau to handle subjects which are of a mechanical nature is, it would seem to me, very apparent.

By invitation this association had a representative in attendance at the annual meeting of the Conservation Congress. The aim and work of this congress are something in which every member of this association is vitally interested, and I believe it should have our coöperation and support in every way possible.

The question of consolidating this association with our sister association, the Master Car Builders', has been discussed for some years, and there has been considerable agitation of the matter for the last three years. Committees have been appointed, but up to the present time the proposition has not been settled. It has been the opinion of a great many of the members that the consolidation of the two associations was not feasible and practicable and I leaned to this opinion, but the more I have studied the subject the more I have become impressed with the idea that the union of these two associations will enable us to carry on the work in a far more satisfactory manner. Those of us who have worked in both associations realize what an extra amount of work and time two associations mean for the individual members, and I personally feel the time is ripe for this consolidation or union of the two associations, and I believe the committee should be so instructed to perfect plans so that this consolidation can be accomplished as quickly as possible.

There are a number of important matters confronting railways at this time which should receive our earnest attention and coöperation. We have under consideration and have had committees appointed to investigate during the past year some fifteen subjects comprising important mechanical problems of to-day, and I trust that the reports of the committees will be carefully analyzed and freely discussed to obtain the full benefit of the able work which has been done.

I would call particular attention to the report of the committee on Design and Construction of Locomotive Boilers. In my opinion this association should arrive at such standards for boiler design as will be adopted and followed by all members.

Before closing, it seems fitting that mention should be made of the efforts of the Railway Supply Manufacturers' Association, which is entitled to a hearty vote of thanks for its magnificent display and the opportunity afforded members of this association to inspect the many new machines and appliances. Gathered about these conventions there has grown up year by year this imposing exhibit with many miles of mechanical displays representing the most complete exhibit of its kind to be found anywhere in the world. Immediately accessible are inventors and designers ready and willing to discuss the merits of their devices. Our sessions are so scheduled that several daylight hours every day can be devoted by the delegates to the study of the very latest suggestions in the way of modern equipment and appliances by which we are enabled to bring about increased efficiency and economy. I desire to urge on every attendant at this convention that he take full advantage of this opportunity.

In conclusion I wish to express my sincere appreciation of the coöperation and assistance of the officers of the association, committees and individuals who have assisted in preparing reports and otherwise rendered efficient service in the work of the association. To you all I extend my heartfelt thanks.

ASSOCIATION BUSINESS.

Secretary Taylor presented his report, which showed that the active membership in June, 1910, was 952; since that time there were transferred to honorary membership, 6; deaths, 11; resignations, 13; dropped for non-payment of dues and mail returned, 1; being 31 deductions from the list as it appeared in June, 1910. During the year there were 78 new members elected and one member re-instated, making the total membership at the present time, 1,000. The associate membership is 20, the same as in 1910. The honorary membership is 43, being an increase of 6 since 1910. The total membership is now 1,063. The following deaths have been recoded: Active members: D. F. Van Ripper, H. H. Johnson, J. B. Gannon, A. J. Dunn, David Brown, Wm. Buchanan, H. S. Bryan, G. J. DeVibiss, P. G. Thomas, J. P. Picciolo and S. K. Hatah. The secretary presented the treasurer's report which showed an income of $6,036.90, and expenses of $5,940.77, leaving a balance of $96.13.

The recommendation of the executive committee that the dues for the ensuing year be fixed at $5 per vote was adopted.

C. H. Rae (L. & N.), J. W. Fogg (B. & O. C. T.), and M. J. McCarthy (C. C. C. & St. L.) were elected members of the auditing committee.

Prof. Louis E. Endsley, Purdue University, and E. A. Averill, managing editor of *American Engineer and Railroad Journal*, were made associate members of the association.

The following committees were named to prepare obituaries: T. Rummey, on D. F. Van Ripper; J. W. Taylor, on H. H. Johnson; G. W. Wildin, on J. B. Gannon; Angus Sinclair, on David Brown; J. J. Conolly, on H. S. Bryan; M. A. Kinney, on G. T. DeVelbiss; C. E. Chambers, on P. G. Thomas, and J. W. Taylor, on J. Piccoli.

The association has four scholarships at the Stevens Institute of Technology. The expenses of the student at the school is taken care of by the fund that we have there, but it does not include boarding. There are no vacancies at the present time and there will not be any until September, 1912. The scholarship at Purdue University given by Joseph T. Ryerson & Son, for which they appropriate five or six hundred dollars a year, takes care of the school expenses as well as boarding the student. The present student graduates this spring, and the Ryerson people are willing to extend this another four years if the association desires to coöperate with them. The executive committee accepted this offer.

The President: In connection with these scholarships there has not been the number of applicants for the scholarships that would be naturally expected in an organization having a membership of a thousand or over, and we would remind the members that it exists.

ADVISORY TECHNICAL.

The committee made a report progress, there being many things which have come up during the past year which have prevented it from making any definite recommendations at this time, among which are the possibility of a consolidation of the two associations, and other matters of like nature. Such a committee is desirable, but the attention of the executive committee is called to the fact that if the committee on advisory technical follows the line of work as it is supposed to do, and if the committee that the president has recommended is appointed, they will both be doing nearly the same work and one or the other should be eliminated.

MECHANICAL STOKERS.

The committee reports that such progress has been made in the development of mechanical stokers as to warrant railways installing a limited number upon large locomotives at least, and thus lend their aid in the perfection of a device which the committee has concluded is a necessary appliance to heavy tractive-power locomotives. The committee is of the opinion that it behooves the members of this Association to participate actively by utilizing such stokers as have been developed, and, by actual application, assist in the solving of the many problems which must naturally present themselves during practical operation. The benefits to be derived might properly be again referred to, viz.: Utilization of the maximum boiler capacity of locomotives. Reduction of black smoke, because of the possibility of maintaining a thin, level fire. Application of coal in more minute quantities. Improved life of flues and fire boxes. The reduced labor required should make the positions of firemen more attractive, which will carry therewith obvious benefits to the railways.

The requirements for mechanical stokers, as recommended by your committee, in brief, are: That they should be capable of firing coal in excess of the maximum requirements of the locomotive. That the fire-box door be free of any attachment which would prevent the fireman from giving such attention as fires may require. That they be entirely mechanical from tender to grate and capable of handling bituminous run-of-mine coal, which will include a coal crusher,

mechanically operated, on the tender. They should distribute the coal in the fire box in such a manner as to call for no assistance from the fireman other than regulation of supply and possibly the adjustment of the mechanical appliances for distribution and maintain an ideal fire for economic coal consumption without emission of black smoke in objectionable quantities.

Previous reports of the committee have directed attention to various mechanical stokers under development, and a summary upon each is presented, with such remarks as are believed pertinent to the subject.

Crawford Underfeed Stoker.—This stoker is in service on the Pennsylvania; its operation has been satisfactory; it is completely mechanical and aims to cover every requirement set forth.

Barnum Underfeed Stoker.—This machine is in the process of development and so far has been used as a distributor only, requiring coal to be shoveled into the hopper. The reports from the Chicago, Burlington & Quincy indcate that the mechanism operated satisfactorily, burning an inferior grade of fuel, showing economic results. It is in successful operation on a six-wheel switch engine and a prairie freight engine. A method of crushing coal on the tank and delivering it to the hopper on the engine is now being developed which will make the device meet all the requirements enumerated.

Strouse Overfeed Stoker.—The manufacturers have increased the scope of the apparatus, which formerly consisted of a distributor only, by adding a conveyor from tender. Satisfactory service has been obtained with regular crews, but the development to date does not permit of complete report.

Street Overfeed Stoker.—There are ten machines in service, including four on the Lake Shore & Michigan Southern, one on the New York Central and the remainder distributed on five other railways. The stoker is designed to meet every requirement suggested by the committee, and is successful in its operation.

Hanna Overfeed Stoker.—The stoker has been developed only as a distributor. Consequently, it falls short of the requirements set forth, inasmuch as run-of-mine coal can not be handled, and shovelling from tender to a hopper is necessary. The device distributes coal into the fire-box very satisfactorily and is rendering good service on the Queen & Crescent, operating on Mallet, consolidation and Pacific type locomotives.

The Hanna stoker is a coal distributor of the overfeed type, using steam jets. The coal is shovelled into a hopper and then pushed up a conduit by means of a short screw. From the conduit the coal falls over a ridge plate onto the fuel-distributing plates, in front of the steam jets. Two wings move over the ridge plate in such a way that the coal is distributed in a cycle over the grates. These wings are also adjustable so that coal may be concentrated on any portion of the grates. They are actuated by a set of levers, connecting rods and ratchets from the main shaft of the stoker. The motive power is furnished by a small two-cylinder reversible engine. The entire device is self-contained and bolts rigidly onto the back boiler head of the locomotive. No mechanism is provided to crush all classes of coal or to convey the coal from the tender to the hopper.

Hayden Stoker.—The original design failed in two particulars, unreliability and poor design of conveying mechanism and the burning out of coal-distributing plate. The modified distributor developed independently from the conveyor avoids the distributing coal plate in the fire box and is giving satisfactory service on the Erie.

Dickinson Overfeed Stoker.—This is a further development of the principle involved in the Hayden stoker and seeks to fulfill the requirements of the committee. It is in operation on the Erie and giving satisfactory results in regular freight train service.

Brewster Underfeed Stoker.—One of the above was recently applied to a locomotive on the Erie, but owing to modification being required the time was too limited to permit of the results being included in the committee's report. The stoker is designed to meet all requirements previously mentioned.

It consists in part of a screw which is placed in the bottom of the tender and covered with movable steel plates, so arranged that a gradual flow of coal is admitted to the screw. The coal is conveyed by means of this screw through flexible coupling to a point below the grates. It is then carried upward through the grates by means of a second screw to the steam jets which are on a level with the bottom of the fire-box door. The blasts from the jets, which work intermittently, are adjustable to meet any condition of fuel or size of fire box.

The grates are divided into four divisions, two on each side, and by means of a cam—one section at a time—they are tilted slightly forward to advance the fire and agitate the grates sufficiently to keep clear of ashes. The whole arrangement is operated by a small double-cylinder engine, located on the left side of the locomotive, below the cab.

Summary Remarks.—Tests comparing inferior fuel used with mechanical stokers to regular supply for hand firing, thus taking advantage of difference in present fuel values, should not be accepted as proof of economy, as such relations would not maintain with the extension to any appreciable number of mechanical stokers.

The progress during the past year has been sufficiently marked to lead the committee to believe that it can present a final report at the next convention upon at least several of the stokers which have already been developed sufficiently to perform actual continuous service.

This report is signed by:—T. Rumney (Erie), chairman; E. D. Nelson (Penn.), C. E. Gossett (M. & St. L.), J. A. Carney (C. B. & Q.), and T. O. Sechrist (C. N. O. & T. P.)

DISCUSSION ON MECHANICAL STOKERS.

C. B. Young (C. B. & Q.): For perhaps four months we have had the Barnum stoker in successful operation on switch engines in Chicago, and it produced no smoke, it has burned inferior coal and keeps up with other switch engines of the same class. The road engine has not been quite so successful as the switch engine, but has been doing pretty good work, and we are now developing for the road engine some modifications, embodying slight differences, which are necessary from the application of the stoker to the switch engine.

H. T. Bentley (C. & N. W.): I suppose the stoker has been put on the switch engine just to keep close observation of it, to enable you to watch its performance more closely, but it seems to me a switch engine is not a desirable engine upon which to put a stoker.

C. B. Young (C. B. & Q.): The stoker was put on the switch engine to avoid the smoke nuisance in Chicago and it is doing it.

George A. Hancock (St. L. & S. F.): I should like to relate an experience with the stoker on the St. Louis & San Francisco with a Mallet engine. It meets the requirements of the committee. The fuel economy is about in line with the report of the committee. The whole economy depends entirely on the fireman. The conveyor apparatus is entirely satisfactory. We have been troubled with the crusher, but that is on account of foreign substances, such as stone and slag on the stoker; outside of that, with the heavy engines, it is far superior to hand firing and the firemen after becoming experienced in the use of the stoker become expert in its use and bring about very satisfactory results. I think it will be easier on the flues. I think it is what we want for a heavy engine.

T. O. Sechrist (C. N. O. & T. P.): We have eight engines equipped with the Hanna stoker. One of these engines, a Mallet compound, has been equipped for 14 months, and during that time we have had two failures. These failures were due mostly to the carelessness of the crew assigned to the engine, but during all the rest of the trips that this engine has made, the performance of the stokers have been entirely successful and satisfactory, and we have had at least 24 representatives of foreign roads riding on this engine. The same thing holds good in case of the Pacific type and consolidation engines equipped with the Hanna stoker. However, it does not meet with the full requirements set forth by the committee as it does not convey the coal from the tender to the fire box.

As far as the stoker being a distributer, I differ a little with the other members of the committee. I think that the stoker can be classed as a stoker only; the conveying and crushing part is only a small matter to apply in conjunction with the stoker. On the trip from Oakdale to Danville, Kentucky, which is a very extremely mountainous country, with grades 60 ft. to the mile, and curves of 6 per cent., at no time have we failed on account of steam on any of the engines equipped with stokers, and at the end of a 137-mile run the fire will be perfectly level. Any time there is trouble with the draft blast it can be overcome by adjusting the steam blast, which is equipped for a high and low pressure blast, and this applies to the back end of the fire box as well as the front. The Mallet engine consumes about 6,000 lbs. of coal per hour while the consolidated engine will run along about 4,500 lbs., and the Pacific type engine will run about the same as the Mallet.

George L. Fowler (*Railway Age Gazette*): I rode one of the engines on the C. N. O. & T. P. the other day from Oakdale to Somerset. We had the full tonnage with a consolidation engine, and about 920 tons was hauled up a 60-ft. grade. In one case, I think, we ran five miles up a 60-ft. grade from the start to the stop in 11 minutes. The engine was not only kept hot during the whole period of

the run, but the steam never dropped below 125 lbs. The fireman on the engine had made only three round trips prior to that on a locomotive and these three had been on this stoker engine. The only information and instructions he had ever received concerning the stoker had been from his engineer in a desire to help him out. A run of 137 miles was made, winding up the last part of the run from Somerset to Danville with a tonnage of 1,200 behind the engine, the total coal consumed on the whole run, my estimate would be, was about 14.5 tons, certainly not more than 15 tons.

It seems to be a comparatively easy thing to make a stoker that will keep up steam. I have seen the Kincaid stoker and the Hayden stoker, and all others, keep up steam under ordinary conditions, but it has been by the use of an excessive quantity of coal. I think that a great deal of the excessive coal consumed by the present stokers on the market is due to the fact that it is such an easy thing to put coal in the fire-box.

The stokers do not handle heavy, lumpy coal with the same facility that they do the crushed coal.

We noticed the very marked difference on that run, from Oakdale to Danville, in the case of the coal we took on at Somerset, the coal put on at Oakdale being a fine coal, and during the run to Somerset, 117 miles, the fire was just as smooth and as fine as could be desired. Two buckets of the fine coal and one bucket of rather lumpy was put on at Somerset and the moment the lumpy coal was put into the fire-box, the blast was not strong enough; the coal backed up against the back sheet, and in the next few miles it was necessary to use the hook three times. The moment the lumpy coal was disposed of, the fire flattened out and there was no trouble whatever after that.

In adopting the use of the stoker the men should be given some idea of what they are going to use, what the stoker is for, how it works, and then have the roundhouse forces take care of the stokers. Give the stoker the proper kind of coal, and if you do that, with any of the three stokers now on the market, there is no reason why an engine should not be fired perfectly. I think that the firing can be done more economically with the stoker than it can be done by hand firing.

I believe the smoke runs between 2 and 3 on the Ringlemann chart, when the engine is working heavy and the fire is being constantly fed by the stoker, but the moment there is any let up the smoke drops right down to practically between 1 and 2, if not down as low as 1; but there is smoke, and constant smoke, with both the Street and Hanna stoker when they are working heavily, but other engines not equipped with the stoker showed greater smoke. I should judge on the ordinary engine, with hand firing and working hard, that the smoke would run between 3 and 4, while with the stoker engine it was between 2 and 3, perhaps nearer 2 than 3.

C. E. Chambers (C. of N. J.): It was my privilege to make a trip on one of the Pennsylvania engines equipped with a Crawford stoker. We had a tonnage train of coal cars; there was no hand firing done at all and there was almost no smoke, except just when the stoker was placed in operation; at that time there would be a discoloration of the steam coming from the stack, but not anything that you would term smoke, such as would come from a soft coal engine. It was about the most gentlemanly job of firing I ever saw; a man could put on a white shirt, and the only evidence that anything was going on was the disappearance of the coal in the center of the tender.

As to steam pressure, you would have thought that they had fixed the pointer. I could not see that it varied one pound at any time. There was not one hitch during the entire time that we were on the engine—nothing occurred which could be considered as unfavorable to the operation of the stoker, except that possibly once or twice the coal blocked the shovel temporarily because of lumps. The tonnage was 1,700 or 1,800, but they said it would have been the same with 3,500 or 4,000 tons.

Geo. L. Fowler: Last year I gave some memoranda in regard to the operation of the Crawford stoker, and that was the reason I did not speak of it this morning. At that time I compared the smoke coming from the Crawford stoker to the average conditions of the Pittsburgh atmosphere. I rode the engine from Pittsburgh to Crestline, and there was no smoke whatever; when I returned I was asked how the steam pressure ran, and I said I did not know; that I thought they must have been monkeying with the gage, because the pointer did not move throughout all the trip.

D. F. Crawford (Penna.): We have made all told 2,000 trips with the stoker. Of these about 1,600, representing very roughly 160,000 miles, have been made with what might be called the improved stoker. There are at present about 20 locomotives equipped. There are 19 in regular service and we have 10 or 12 more under way. The stokers have all been applied, with the exception of three, to H-6 consolidation locomotives. Two of the stokers are placed on a larger consolidation locomotive and one on a switch locomotive.

The stokers up to three or four months ago were in the hands of regular crews; in some cases a man rode with them. He was called a stoker instructor, and was simply a fireman who had been taught what the different parts consisted of and what was expected to be done with them. It was his duty to teach the other firemen how to handle the stoker. About three or four months ago five or six of the locomotives were assigned to one division and were turned over to the pool. Out of 1,500 or 1,600 trips that the latest stokers have made, about 800 of them have been 100 per cent. stoker fired; that is, no coal was put in by the shovel at all. One thousand trips have been about 90 per cent. stoker fired or over, and the average of all trips is somewhere about 90 per cent.

The stoker has been on the testing plant at Altoona. We have made a number of tests with the Salinville coal, which we use regularly, and we have succeeded in firing 6,300 pounds of coal per hour. We have fired that successfully and maintained the steam pressure with it; the performance was in every way satisfactory. I agree fully with the conclusions of the committee as to the desirable points of the stoker. I disagree with Mr. Sechrist, who said that the conveyor should not be used. The stoker is not complete unless it does the whole job. The first stokers that we had were without the conveyor, and they did not appeal to me as meeting the situation.

Something has been said about coal economy. From the results obtained on our testing plant I think we will do as well, or even better, than the best hand firer. On some of the tests that we have made the stoker has shown conclusively that it will save coal as compared with the average hand firing. However, I do not look to coal saving in itself as being the important point of the stoker. To me the important point is to be able to rate your locomotive not on the size of the cylinders, but on the pounds of coal that it burns. Our consolidation locomotives are probably using from 3000 to 4000 lbs. of coal per hour in regular service over a continued run. We want to rate those engines at 5000 lbs. of coal per hour, and make the train behind the engine a 5000 lbs. of coal per hour train and do what such a train ought to do. We do not have to build any heavier or bigger engines. All we have to do is to burn more coal and use the engine that we have up to its adhesive ratio.

One of our consolidation locomotives was put in switching service in one of the large cities where they have a smoke inspection bureau in operation with well trained observers.

One of these trained observers took notes and made observations of this engine at different times for a period of 40 hours. He made a total of 9,754 smoke observations, of which 9,550 were No. 0; 570 were No. 1; 20 were No. 2; 10 were No. 3, and four were No. 4. In other words, 8½ per cent. of the smoke was eliminated on this engine engaged in switching service. One difficulty is that west of Pittsburgh we use the Ohio coal, and east of Pittsburgh the coking coal, and we have had some little difficulty with the latter.

C. F. Street: I have put 10 of these machines in service. There are two or three matters on the general stoker situation that I would like to bring up. The first is this: The main object of putting a stoker on a locomotive is to increase its capacity. As Mr. Crawford has said, the capacity of firing is about 2½ to 3 tons per hour. With the stoker you can jump up to 5 tons of coal per hour, and with the increased capacity you at once increase your tonnage. The master mechanic of one road where my stoker is running said that if they equipped their locomotives with the machine he would be able to increase the hualing capacity of the locomotives from 15 to 20 per cent. That is the key to the whole proposition. You get a stoker that will do that and the question of fuel economy immediately becomes secondary. You can afford to burn considerable more coal per unit of work. Another point is the increased speed that the locomotive is able to attain. It will work on grades which the hand-fired locomotives cannot. I can put any kind of stoker on a locomotive and it will run at a speed of 20 to 30 miles an hour, with any kind of tonnage, and work like a watch. Load the locomotive down with all it can haul, bring it to a grade and slow down from 5 to 8 miles an hour, and you have a very different proposition. The stoker for passenger locomotives looks so easy that it seems to me a shame not to use it, as the conditions are ideal.

There is no question but what the scatter type of stoker will do. By applying it a great deal of the smoke will be

eliminated. A great part of the trouble is that your firemen are not given full and definite instructions as to how to use a stoker. There is no piece of machinery that you put into the hands of a man and do not give him some sort of instructions as to its use. I have put stokers in where the fireman has never seen one before. Of course, you furnish the fireman a pamphlet descriptive of the stoker, but how many of the firemen read it. These men should be given full instructions. You would not think of putting a man on a train to handle an air brake without giving him instructions. Look at the schooling that you put your engineers through before they are allowed to run a locomotive. When it comes to the stoker it is going to be necessary to have some man, or to have a department, or a set of men, who shall make it their business to instruct the firemen in the proper handling of the stoker.

The question of whether the crusher shall be on the tank or not is very material. I am building a machine now that will take the coal by a conveyor from the tank, and put it into the firebox without the use of a crusher.

I made up my mind that a stoker in order to be successful would have to handle any quality of coal that was given it, and take anything from poor slack to the best lump coal. Here is an excerpt from a report from a railway company that had a man on an engine watching the operation of the stoker: "We received 1,700 pounds of coal, only 5 per cent. lumps; the slack was composed mostly of sand and mud, and we could easily make a mud ball of this coal, but still the engine done well on it." The keynote of this whole question is increased tonnage and increased speed.

M. H. Haig (A. T. & S. F.): I did not intend to say anything on this subject because my experience is not at all complimentary to the stoker, and I have found it quite difficult to believe my ears this morning. I might give you a history of its operation on the Santa Fe. Three types have been applied on locomotives operating through a territory where the ruling grade is about .6 of one per cent. Every opportunity has been given to the stoker representatives to instruct the firemen.

Mr. Fowler claims that the coal should be selected to suit the stoker. I do not think that is practicable. The stoker must be selected to suit the coal. The three stokers we have in operation are the Hanna, the Street and the Strouss. In hand firing these locomotives they used about 14 tons of coal per 100 miles. They hauled about 2,000 tons, largely in refrigerator cars, and it was found that the stokers—especially the Street and the Hanna—required from 18 to 20 tons over the same distance. The stokers have made very few trips without having to run for coal. The Strouss stoker has been more successful in respect to economy. However, the firemen claim that they have to work as hard using these stokers as they did in firing by hand because of the labor required in lifting the coal up to the hopper. The Strouss stoker is a noisy appliance, and not a very pleasant device to have in the cab, but it has done the work. The trouble with the Hanna and Street stokers has been that they bank the coal near the back end of the firebox, and that has caused some trouble.

As to providing coal suitable to the stoker, at the request of the Hanna representatives different kinds of coal were provided; the firemen were given lump coal and slack coal. It was claimed that the lumps were too large, and they were given slack coal, and it was claimed that there was trouble with that —that it banked.

J. F. Devoy (C., M. & St. P.): I have just completed a year's experience with the Strouss stoker, and as I have nothing complimentary to say about it, I am not going to say anything at all about the stoker. I agree with Mr. Crawford that a conveyor is an absolute necessity for the reason that it will lessen the work of the fireman. The actual work involved in lifting the coal is 50 per cent. more when firing with a stoker than when firing by hand. A conveyor on any sort of a stoker is thus an absolute necessity. My real object in rising to speak at this time, however, is to question the Ringlemann chart system. In Chicago it is almost an absolute impossibility to live up to the smoke law. The Ringlemann chart was never intended to be used for any such purpose; it was gotten up originally by an eminent engineer for the purpose of judging a smoke from a factory stack, in which there was no mixture of steam, and it should only be used for that purpose. The greatest amount of smoke emitted from a stack is usually at the starting of the engine. The greatest amount of steam is mixed with the smoke when the greatest amount of work is done, or when the greatest amount of coal is burning. Therefore, the Ringlemann chart is misleading in judging the smoke or the color of the smoke emitted from a stack, due to the fact that you are judging 75 per cent. steam and not smoke. The committee should define at what time the Ringlemann chart should be used, for it is misleading.

As to whether a stoker will save coal or not, the results of our one years' experience show that hand firing saved 9 per cent. over firing by a stoker.

C. F. Street: You say that by hand firing you save 9 per cent. in coal. Was the speed at which the machine was operating taken into consideration in arriving at that conclusion?

J. F. Devoy: My remarks are based on our experience of 12 months in which an exact record of the coal consumed was kept; that is, the average performance of the locomotive in both directions over a single division. The figures were 10.71 pounds per 100 ton miles for the stoker fired locomotive and 10.54 pounds for the locomotive not equipped with a stoker.

W. C. Hayes (Erie): My views have changed somewhat from those I expressed at the last convention. I said then that I did not think stoker firing could be compared in any way with hand firing, and that if we undertook to expend the same effort in educating the firemen that we did in developing the stoker we would get better results, which would more than overbalance anything that could be obtained from mechanical stoking. Since that time the development of the stoker on the Erie has brought about a change in my opinion, and I think now that perhaps we are on the right track to enable Mr. Rumney to say that he will be able to complete his report to this association in a satisfactory way by the time of the next convention and show a stoker that will deliver the goods.

E. W. Pratt (C. & N. W.): I would like to ask those who have had most experience with mechanical stokers what is the low limit per hour in the amount of coal to be supplied the fire box. What would they recommend in that respect? Would it be 4,000 or 3,000 lbs. per hour? Below what point would they consider it inadvisable to apply mechanical stoking?

D. F. Crawford: I have not worked on the low limit. I have been working on the high limit, trying to raise it all the time. As I understand Mr. Pratt's question, he asks whether it would be economy to put a stoker on a locomotive using a comparatively small quantity of coal. We have not, because we do not expect to have locomotives in service, except perhaps small switching locomotives, where we would apply the stoker from the smoke preventive viewpoint. In all the cities through which our lines run there are now smoke ordinances. I would not recommend putting a stoker on a light passenger engine.

J. F. Devoy: The daily record of our trains that I referred to shows a consumption of 3,500 lbs. of coal per hour. This is equivalent to 72 lbs. of coal per square foot of grate per hour.

Mr. Steele (American Locomotive Works): I think where the coal consumption runs above 5,000 lbs. of coal per hour a mechanical stoker would greatly relieve the labor of the fireman and would permit an increase in the work of the locomotive.

C. E. Gosset (M. & St. L.): The Strouse stoker will do well when it is working. We have had numerous troubles due to its failing and found it necessary to discontinue our experiments because of the number of failures that we experienced. As long as we had the stoker in the hands of a regularly assigned crew who were thoroughly familiar with its different parts and how to take care of it we obtained very good results, but when the machine was turned over to a different crew our troubles began and finally they became so numerous that we discontinued our experiments.

M. H. Haig: I would like to ask some questions of those gentlemen who have operated stokers successfully. Have they ever had any trouble with the Hanna and Street stokers banking the coal under the door? Have they ever had any trouble with particles of the coal being carried through the flues and out of the stack? Did they have to provide a special quality of coal? In the case of the Street stoker I do not think it is necessary to provide a special coal.

T. O. Sechrist (Q. & C.): We use the regular nut and slack when we can get it. We take by preference about 90 per cent. of slack. The crews prefer the slack coal, as they claim that makes them less trouble. As far as carrying the fine particles of coal through the flues is concerned, I believe that is all due to the handling of the blast. If you use high pressure blast, of course it occurs. We had that trouble at first, but we have overcome it, and I have not heard a word of complaint on any engines that we now have equipped with a stoker.

We have not experienced any trouble due to the banking of the coal around the fire door; I have made at least 100 trips with the stoker and have not observed any trouble of that kind.

J. Christopher (T. H. & B.): What is the experience of those using the stoker as to the front end filling up, as compared with hand firing? Is it necessary to clean out the front end more frequently?

T. O. Sechrist: We have been using the stoker for the past 14 months, and at first we did experience that trouble. We have

had no trouble along that line lately. We have not had any occasion to inspect engines on account of the filling up or on account of coal being drawn through the tubes, and we have watched that matter pretty closely, thinking that perhaps the coal might bank up around superheated pipes.

G. A. Hancock (St. L. & S. F.): Regarding the Street stoker, I would say that we have had a great deal of trouble of the same nature that Mr. Haig spoke about. I think possibly 10 per cent. of the trouble is caused by faulty firing, and the minute the fireman becomes accustomed to the stoker it works better. We have had some smoke trouble on heavy service, but on light service it has been comparatively small.

C. F. Street: In answer to Mr. Haig's query regarding coal going through the flues to the stack. On my first machine I had a great deal of trouble with the coal being carried through to the stack unconsumed. As I said before, the first machine I ever built is now here on the pier, and it has a screen for screening the fine coal out and depositing it across the back end of the grate, where it does not get into the fire-box. I have two of these engines working. On the question of banking, I have put in a division across, so that the rolling of the locomotive has no effect on the distribution of the coal in the fire-box, and I am arranging to rebuild the machines that I have out and put this device in them. The experience that I have had with these machines shows that the two points of difficulty pointed out will be entirely eliminated.

Angus Sinclair: A very important point in locomotive operation is the condition of the flues. If the mechanical stoker has a tendency to cause more flue trouble than is experienced with hand firing, or the reverse, why, it is very important. I suppose those who have had experience with stokers are able to tell whether there is less flue trouble, or more flue trouble, using mechanical stokers than there is in hand firing.

T. O. Sechrist (Q. & C.): We have had no flue trouble with our stokers, but we have had with all our locomotives that are not equipped with mechanical stokers.

D. F. Crawford: My experience is favorable to the use of stokers. We find very little difference between hand stoking and mechanical stoking, but whatever difference there is between the two is in favor of the mechanical stoker. Our flue troubles are not the flue troubles that we used to have. There is nothing like so much flue trouble or flue leakage today as we had formerly. I am afraid to say whether it is due to the stoker or due to the difference in practice in our engine houses, but I am inclined to think it is due to the latter.

T. Rumney: Mr. Sechrist expressed the opinion that a conveyor is not necessary, and that it is a very small matter anyway. All I can say about that is that I wished we had found it to be so. We have been four years trying to get a conveyor, and we are only able now to say that we have a conveyor. I think Mr. Street has had some trouble, and I am sure Mr. Crawford has had from what he has told me in the past. Some of the tests that have been made show that we got within 1.2 per cent. economy, taking time into consideration. That is, we considered the work, checked by the dynamometer horse power, and by fuel hours, per ton mile. The committee took into consideration the fuel burned and gave credit to the locomotive for the tonnage drawn in a given time or in a given distance.

The reference that Mr. Crawford made to the rating is precisely the line upon which the committee has been viewing the question: that is, making the modern locomotive better and more powerful, and not seeking to economize in fuel consumption in order to make a good showing on a fuel basis, but figuring on a ton mile basis; and, on a ton mile basis, it is almost equal to hand firing. Of course, in every case, the hand firing was fairly good, and the stoker was new.

All the experience that I have had with the mechanical stoker shows that there is very little smoke either with a scatter, Street, Hayden, or Dickinson type, and I know that the Crawford stoker is nearly smokeless.

In respect to the reference that has been made to the underfeed stoker and the scatter feed stoker: There might be some advantage in the scatter feed type in that the smoke would always be visible, more or less. But I do not know about this, as we have not made any experiments in that line.

REVISION OF STANDARDS.

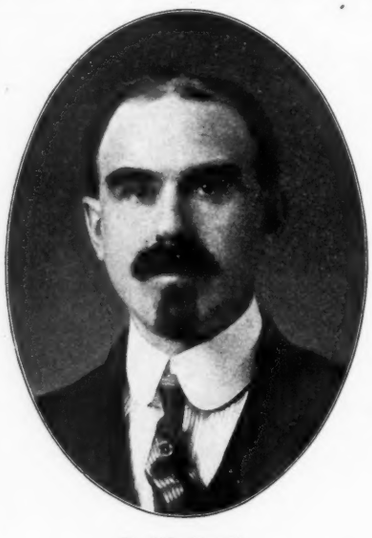
D. F. Crawford: Mr. Demarest, of the Pennsylvania Lines, is chairman of this committee, but an emergency occurred during the last month which has prevented him from giving the subject his attention.

SMOKE-PREVENTING DEVICES FOR FIRING-UP LOCOMOTIVES.

The committee sent out a circular of inquiry and many of the largest railway companies who have terminals located within the large cities where the restrictions are most severe were included in the 33 replies received; hence, we believe that this subject has been more thoroughly canvassed than might otherwise appear. The various reports and the experience of the individual members of the committee would lead to the following recommendations:

The best results are obtained by filling up locomotive boilers with hot water previous to firing up; the temperatures reported vary from 110 deg. F. to over 200 deg. F., but the higher is preferred on account of aiding combustion and lessening the time required to raise steam in the boiler. Where hot water is not available, the temperature of water in the boiler may be raised by injecting live steam below the water line; but on account of the loss of time the heating of the water, either before or while the boiler is being filled, is recommended.

Two roads reported the use of large fans, connected with the smoke jacks above the roundhouse roof, as a means for producing draft. One of these roads advises that this device was used and tested for a considerable length of time, but was found unsatisfactory and abandoned. The other road is still experimenting along this plan in connection with a smoke-washer, and is not yet ready to report upon its results except as to its difficulty in the maintenance of the plant—the material parts having been eaten out several times during the year's experiments. All other roads report the use of a roundhouse steam blower and the locomotive blower used exclusively.



E. W. Pratt.

Chairman, Committee on Smoke Preventing Devices.

From the reports it would appear that almost every combination of wood, fuel oil, shavings, cobs, coke and bituminous coal had been used, with more serious objections to some than others. Several roads reported extensive trials of coke, but its use has been almost entirely abandoned because the ashes and gases emitted from the smoke jacks are much more objectionable than smoke when roundhouses are located near viaducts or high buildings; furthermore, it is almost impossible for employees to work in the roundhouse when engines have to be moved from under the smoke jacks to do necessary work, and also the cost of coke is greatly in excess of other fuels in most sections of this country. While the smoke from wood varies considerably in accordance with the size, quality and amount used, still it is more generally employed for kindling fires than any other fuel where the greatest effort is being made to prevent smoke at such times.

The plan of raising steam to nearly working pressure by means of wood or coke alone has been tried by many roads, but abandoned when it was found that the same results could be obtained by adding bituminous coal carefully to wood fire after the temperature in the fire-box had been somewhat raised.

In general the conclusion is that although there are many devices for reducing the amount of smoke from locomotives after steam is raised and the engines are working, and while it is possible by great care and attention on the part of the roundhouse force to reduce the amount of smoke emitted during this period, there is no practical way to entirely eliminate all smoke while firing up locomotives at terminals.

The report is signed by:—E. W. Pratt (C. & N. W.), chairman; J. C. Mengel (Penn.), R. W. Bell (I. C.), J. B. Kilpatrick (C. R. I. & P.) and E. F. Jones (C. & W. I.).

DISCUSSION ON SMOKE PREVENTING DEVICES FOR FIRING-UP LOCOMOTIVES.

A. E. Manchester (C. M. & St. P.): The recommendations of the committee are directly in line with our best efforts, the filling of boilers with hot water. The only point that they do not refer to is time. It is decidedly of advantage to take sufficient time so that the work of bringing an engine up to steam pressure is done slowly. We have found nothing better than kindling wood to start a fire with, a good liberal allowance of it, and then to feed the coal in slowly and have the coal well broken up as it is fed into the fire box and use the force blowers to assist the fire to burn readily. With us, following these methods, we have found it largely a question of keeping our men up to their work and not let them hurry it. Just as soon as you begin to hurry the men, why, they begin to do the very things that produce smoke and cause trouble.

W. C. A. Henry (Penn.): Our experience has been pretty much covered by what is stated in the remarks of Mr. Manchester. The point where smoke is objectionable is in using shavings saturated with oil. Where smoke is objectionable to the city authorities we have taken old ties for firing up, and by not hurrying very much we have been able to make a very considerable reduction in the quantity of smoke emitted, yet at the same time there is smoke.

J. W. Fogg (B. & O. C. T.): I think our best results have been secured in using kindling wood where you have the roundhouse men thoroughly drilled. If they get careless in the roundhouse, why, it does not eliminate the smoke nuisance. We have found that if we apply kindling wood and then apply the coal very lightly we get good results.

T. H. Curtis (L. & N.): About eighteen months ago we equipped one of our roundhouses with a smoke washing device which had been recommended to us by the smoke department of the city. This device consisted of a duct connecting the smoke jackets in the roundhouse through and to a fan, and from there to a large tube into which was injected a spray of water, and the washing of the smoke precipitated the carbon and made it very much less objectionable. We constructed these ducts of steel, and before we got the thing fairly installed or running more than six or eight weeks the first duct was found to be entirely eaten out, due to the combination of the gases and moisture. We renewed the duct with wood. Then when we looked at the fan we found that the fan blades were eaten out and the fan housing had begun to go, and that the whole thing was practically a wreck.

R. D. Smith (B. & A.): We are working under very strict conditions in relation to smoke in the city of Boston. We have in all of our important terminals hot water wash-outs. I find that the recommendations of the committee are about in line with the best practice as we have found it in our experience. A great deal depends on the fellow that is doing the firing in the roundhouse, and whether you are in a hurry for the engine or not. With the hot water wash-out system, where you can fill and wash out with hot water, we find that firing with ordinary kindling wood is about all that we can do. We object, however, to using old ties or old discarded wood for firing of locomotives. The reasons for that are the likelihood of spikes and nails being in the ties and getting into the fire-box, getting caught in the grate and causing engine failure. So we try to keep away from the use of old wood unless it has been looked over carefuly.

S. L. Bean (A., T. & S. F.): We have very little trouble with smoke. We employ all kinds of men to build the fires—Japanese, Mexicans and Indians. We obtain very good results, especially at the prominent terminals. At Los Angeles we probably handle two-thirds of our locomotives in firing up, and by handling the oil carefully it can be so regulated as to avoid the emission of smoke.

M. J. McCarthy: I might say that the practice with us is about the same as that recommended by the committee. While we do have some black smoke necessarily, we find that by paying great attention and care to the operation of firing we can do away with the most of it.

Angus Sinclair: There is no question but what leakage used to frequently occur, and fractures too, by reason of very violent fires being started up to begin with, as, for instance, when they sought to get up steam in a hurry. This trouble might be experienced with locomotives where you were firing with oil if you were to start the fire too violently at the beginning, and the query in my mind was whether it was not better for the sake of safety to fire up gradually.

S. L. Bean: I would say that of course it is necessary to be careful in handling the oil. Not only that, but if you allow your atomizer to work too strongly at the start the oil will drip and there may be danger through that of a conflagration.

C. E. Chambers (C. of N. J.): We use old ties, as much as we can get them, and have never had any trouble, as Mr. Smith spoke of, with the nails or spikes. We at one time used fuel oil, but for the last three or four years we have used gas tar, which is a bi-product recovered from the manufacture of pintsch gas. We use that for firing our locomotives, and we sometimes fire them with coal alone, and sometimes with wood. The latter process makes a great deal of smoke, and where you are held strictly to account by ordinances aimed at the smoke nuisance, it is not so desirable.

C. E. Gossett (Iowa Cent.): I have tried all manner of schemes that I could think of, or have seen in print, in order to obviate this trouble, and I have come to the conclusion that there are but two points we can consider, the first is to not hurry your men in firing up the engine, and the second is to use as much wood as you can get—the more wood the less smoke.

J. F. DeVoy (C. M. & St. P.): I have made efforts by personal observation and inspection to get our engine men to control the volume of smoke in firing up by care to the method in which they do the firing. I have found no fault with the Ringelmann system, and I have stated to city inspectors when an engine passed by, under full head, working full, that in my honest opinion there was not ten per cent. of smoke, and the inspector has called that steam. I simply want this committee, or the other committee to define how far the Ringelmann chart shall be used in connection with the locomotive.

Mr. Borton (St. Louis Ter.): We fire up 125 engines right in the city, and the smoke question is a live one there at the present time. We find, however, that our experience is about in line with the report of the committee. We have not been able to find a way to eliminate the smoke during the firing up of the engines. We have used old ties, generally with very considerable trouble, on account of the spikes and bolts and things of that sort. We have, however, a device which is being put into use called the Parsons system of combustion, and we expect to eliminate the smoke to the extent of about 50 per cent. The Parsons system of combustion is a very practical device on the road, and eliminates from 80 to 95 per cent. of the smoke.

John Tonge (Minn. & St. L.): I wish particularly to say that your expressions here will have considerable weight in these law suits which are pending, based on the Minneapolis ordinance, and the weight of your opinion will be in favor of the railways. I have no doubt that the railroads will follow this matter to the supreme court of the United States if the state courts of Minnesota say that we must use smokeless coal in order to obviate this difficulty. The smoke inspectors are very arbitrary—they say they do not care what railroad is concerned, that we have got to comply with the ordinance, and they are going to compel us to eliminate the smoke emitted from the engines. The commercial club of that city will get together, get the business men together, and they even go so far, gentlemen, as to say and to intimate if you do not do so and so we will ship our goods by another railroad. So I say, what you say here to-day, whatever evidence you can give us on this subject will assist us very greatly.

A. E. Manchester (C., M. & St. P.): I think we might perhaps live under some of the laws that are being enacted if we were given an opportunity to have them interpreted by the Supreme Court of the United States as to the "reasonableness" or "unreasonableness" of these laws, especially the ordinances against smoke.

E. W. Pratt: Mention was made by one member of the use of the air blower, and I judge that is merely to induce a draught. There seems to be no reason in the minds of the committee why an air blower for inducing draught would be any better than a steam blower, nor quite as good. Mr. Bentley described our smoke washer, with which we are still experimenting, but I might add that in order to reduce the concentration of the sulphuric acid in the water that is used to wash the smoke, it takes about a half a million gallons of water a day, which at seven cents a thousand gallons represents about thirty-five dollars a day for water.

The ordinances of several of the cities contain the words dense smoke, which the railway men generally call black smoke, and which is interpreted as smoke through which objects are

not readily discernible. A large locomotive generally develops 1,500 h. p. and perhaps has a stack 22 in. x 24 in. in diameter. While the velocity of the gases and smoke is greater than a chimney or stationary stack would be, there seems to be a good deal of feeling that the density of the smoke from that small diameter of stack would be greater, especially when mixing that smoke with steam or condensed steam, which is a combination not readily penetrated by the vision.

With regard to the use of the Ringelmann chart, and its use in viewing moving trains, it is practically impossible for an observer, unless he is on the train, which they seldom are, to see a locomotive stack at the same angle. They see an engine and a train approaching, when, no matter which direction the wind is in, they get an oblique angle through the trailing smoke, and then they later see the locomotive receding and get about the same angle, whereas we all know if you see a stack approaching and look through the smoke, it looks very much more condensed than it does when you stand at one side and see a train moving at right angles to you.

The replies of the committee indicated that where wood was rather scarce the use of old ties, and especially scrap car wood, was the general practice.

BEST CONSTRUCTION OF LOCOMOTIVE FRAMES.

The committee, called upon to make a report on locomotive frame construction, has given the subject very earnest consideration. Lawford H. Fry was unable to meet with the committee on account of living in Paris, but sent information showing the practice and experiences of various foreign railways. At the convention in 1904 this subject was ably handled by a strong committee, and notwithstanding the great increase in size of locomotives, the committee's recommendations still hold good and the frames still break. Cast steel, made to a rational specification, careful foundry manipulation, adequate and suitable annealing, was spoken of as one of the remedies for frame breakage at that time, and it still is the favorite material, if properly designed, made and annealed. The clip binder was then, and is now, more used than probably any other type, the bolt and thimble style having been discarded in modern practice, owing to stretch of bolts. The specifications suggested by the committee of steel-casting manufacturers, and submitted to the Association in 1904, are as follows:

Material:

Acid open-hearth steel..... .28 per cent. carbon. .05 per cent. phosphorus. .05 per cent. sulphur. .60 per cent. manganese.

Frames will be rejected that show:
Less than .20 per cent. or over .35 per cent. carbon.
Over .06 per cent. phosphorus.
Over .06 per cent. sulphur.
Over .70 per cent. manganese.
Tensile strength per square inch, not less than 55,000 lbs.
Elongation in 2 in., not less than 15 per cent.
All frames to be annealed.

After seven years it would be interesting to learn from the members if these specifications are entirely satisfactory, or, if not, what changes should be made to make them so. While the breakage of a frame is a serious handicap, especially during busy seasons, yet the work of repairing has been simplified so that it is now possible to weld them in place with Thermit, oil, etc., and what used to be a two weeks' job, when all wheels had to be removed and frame taken to blacksmith shop, can now be repaired in place by dropping one pair of wheels and using oil, etc., and engine returned to service in a few days.

The committee herewith submits conclusions and recommendations:

1. That frame breakage is even more general and serious than was first believed, very few roads being free from this trouble. The longer the wheel base of engine, ordinarily, in combination with a roadbed having comparatively short curves, and with frames poorly designed or of inferior metal, or engines not properly kept up, the greater the trouble will be with frames breaking. This latter factor may not be reflected until after the engine has been put in good condition, and then a frame may finally break as a result of the previous poor condition of the engine.

2. The committee believes that with frames properly designed, if made of a good quality of cast steel, thoroughly annealed, with suitable cross bracing and engines kept up in reasonably good shape, breakage will practically be overcome.

3. That a cast-steel, one-piece frame, properly designed, of good material and thoroughly annealed, is better than a wrought-iron frame, because of the difficulty in welding up the large section in a perfectly satisfactory manner, and also because, in casting, bosses, lugs, etc., can be added without the necessity of bolts and studs.

4. That a bar frame is better than a plate frame, this being the opinion of people who have used both; the plate frame causing about as much trouble with breakage in Europe as bar frames do in this country.

5. The strap binder appears to be the favorite form of tying frame jaws together, although the cast-steel box binder, with adjustable wedges, has a number of friends, on account of its simplicity and ease with which it can be handled. The toes at base of jaws should be of sufficient depth and size to give plenty of metal to anchor to, whichever binder is used.

6. Cases have been reported where frame breakage was directly traceable to expansion of boiler, not being properly taken care of by the use of sliding shoes; these shoes, if too tightly fitted or cramped in bolting, or if not lubricated, may prove unsatisfactory. Supporting a boiler by means of vertical plates, if of sufficient strength, provides a satisfactory means of taking care of expansion without imposing undue strains upon the frames.

7. The committee recommends to steel manufacturers the necessity of making a study of locomotive-frame casting, and its proper annealing, as a number of roads are using wrought iron, but would prefer steel if they could secure reliable castings.

8. As a general proposition, frame breakage does not ordinarily occur until engine has been in service two years or more, the older the engine the greater the trouble; they have broken earlier than this, however, on account of flaws, poor welds, or other defects.

The following is an abstract of replies to questions:

The breakage of locomotive frames appears to be very general, from the nature of replies received, as twenty-four representative roads out of twenty-five stated that they were having trouble in this direction; one road, with only fifty-nine engines, reported no trouble; another says, having some trouble, but nothing serious, while a third replies that, with cast-steel frames, considerable difficulty is experienced.

The absence of frame breakage reported by the Trinity & Brazos Valley, having fifty-nine engines, is explained by Mr. Seabrook, the superintendent of motive power, and a part of his reply follows:

"We attribute our success in preventing frame breakage to engine-house attention. The engines are entirely looked after by the engine-house force. Engineers are not held responsible for the inspection of engines underneath. When an engine arrives at the engine-house, the inspector makes a very thorough inspection, and every bolt that shows any indication of working is immediately removed, the holes reamed out and a new bolt applied. Whenever it is possible, our practice is to equip each bolt with two nuts. This engine inspector also looks after the setting of wedges and keying up the rods, reporting the work that is necessary to the engine-house foreman, who assigns the men to make the repairs. The age of engines runs from four to twenty-five years; the worst curve on the road is 9 deg. 30 min."

The committee found the frame breaking difficulty was being solved in a number of ways. The binder and bolt appear to be responsible (when not kept tight) for considerable trouble; some roads report that they watch this very closely. Another road is applying new and heavier section to frames that are breaking. Reinforcing frames and lengthening splices is reported as being helpful. Where wedges are not kept properly in place there will be more liability to frame breakages than where they are kept snug. Splices working will cause strains to be thrown on other parts of frame, and probably cause breakages. Extending the short top-splice back over the front-pedestal jaw has relieved some roads of trouble. The adoption of the Walschaert, or other outside valve gear, has probably done more to overcome trouble than anything else, on account of allowing additional bracing and stronger frames. Some roads have increased the thickness of metal in both rails of frames and have applied heavier cross braces. One reply indicated that the movement of driving boxes so that top of the box would strike the frame was a bad thing for the frame, and for the engine crew. Revised valve setting, so as to reduce compression, is reported to be helpful. It is stated that applying hammered-iron sections has also overcome the difficulty.

The committee also received a number of replies to the question: "Have you any data as to age of frame at time of breakage?" and found that few breakages occurred in less than two years from date the engine was built, but after

that the breakages became more frequent as age increased; cast-steel frames appear to be more unreliable than forged frames, some of the latter running from four to eight years before giving trouble. On some roads the change of valve gear from inside to outside, when accompanied by suitable cross bracing, has apparently overcome the difficulty, but in other cases it has been aggravated.

The replies received indicate that all of the heavier power is more liable to breakage than the lighter engines, which would seem to indicate that the strength of frame has not increased in the same ratio as the power of the engine. The Atlantic, Pacific, Mogul and consolidation types seem to be giving lots of trouble on the different roads, and engines with inside valve gear appear to be more troublesome than with outside gear; this being probably due to their age and the larger number in service. Cast steel and wrought iron are about equally used for frames, the former breaking due to poor castings, defects, shrinkages, etc., while the greatest difficulty with the latter is in getting sound welds. To show the extent that frame breakages occur, one road in the United States had thirty-nine per cent. of the total number of engines passing through the shops with frames broken, so they had to be welded—those, of course, being bar frames—whereas one English road with 1,545 engines, having slab frames, had over ten per cent. of this number broken; but it was stated that frames could now be welded with oxy-acetylene in two or three days, whereas before it used to take them several months to make repairs. It is stated on excellent authority that cast steel does not have as great a life as wrought iron in locomotive frames. On one road the breakages were tabulated, and show that of a certain number of engines the life of the wrought-iron frame averaged 5.9 years, as compared with 5.5 years for cast steel, and that, on account of the great difficulty in getting homogeneous metal, uniformly annealed, wrought iron was preferred. A large number of breaks occur from checks started in key ways, and it is suggested that proper fillets be made instead of leaving sharp corners. Switch engines appear to be particularly free from trouble on account of frames breaking, which may be due to the fact that their frames may be heavier in proportion to the work they have to perform. Only one reply stated that switch engines were in some cases giving trouble, and this was from a switching association. Frame splices, as a general proposition, give lots of trouble, on account of working, and several roads are now using a front-frame section which is welded on to the center of front jaw after the old part with splice has been cut off.

One of the members, replying to the question, "Do you have more frames break with inside than with outside valve gear?" gave some very interesting data on a large number of consolidation locomotives, all built about the same time; of 228 with inside or Stephenson gear, 16 per cent. gave trouble in one year (November, 1909, to November, 1910), whereas, with the Walschaert gear, 172 passing through shops in same period, 18 per cent. of them had to have frames welded, and it is probable that the design was responsible for this condition. A number of roads are using vanadium-steel frames experimentally, but on account of the short time they have been in service it is not possible to state positively results obtained. One road reports a vanadium-steel frame broken after being in service eighteen months, and another in four months, while another states that two vanadium-steel frames broke in four months. Where power is kept up in absolutely first-class condition and proper care is exercised in regard to frame bracing—pedestal binders or caps kept up, frame bolts and cylinder keys a proper fit, and by giving attention to driving-box shoes, wedges and brasses, and machinery in general, so as to avoid excessive pounds—there will be less liability to trouble with frame breakages.

The question of cross bracing has been given considerable thought, and it was found that it was possible, perhaps to have the frame so rigidly braced that trouble would occur, but that where a bracing was used that permitted a small amount of flexibility, it was better for the engine as a whole, and the frames in particular. It is recommended in cross bracing, that ties be fastened full length of pedestal jaw, vertically on rear pedestal, of each driving wheel, or as close an equivalent to this design as governing conditions will permit. The thickness of bosses on cast-steel cross-tie braces is to be not less than 1½, preferably 2, times the diameter of bolt used in fastening. All bolts, where possible, to have heads next to castings, to insure full bearing on bolt.

$$\text{Diameter of bolt at thread} = \text{nearest } \tfrac{1}{16}\text{-in. to } \frac{\text{Width of Frame}}{4}.$$

Where size of bolt comes in even sixteenths, the smaller diameter will be used. Body of bolt to be 1-16 in. larger.

As outside gears, with inside cross bracing, have been in use a comparatively short time, it is a difficult matter to say just what effect the cross bracing has had on frame breakage, but replies received in answer to our question No. 12 would seem to indicate that it is beneficial, and the committee believes it advisable, but is not yet prepared to say what design is best suited for all classes of power. The four-cylinder, balanced locomotive will be less liable to frame breakage, because of more uniform turning movement than a two-cylinder engine, but there is not sufficient data to confirm this theory. The fact that all these engines are comparatively new makes it difficult to get much information about them.

It is the committee's recommendation that a one-piece frame be used on all engines with piston valves, preferably with cast-steel filling between cylinders and bumpers, but on slide-valve engines it is usually necessary to resort to a two-piece frame, because of lack of strength at cylinders. For engines having trailing trucks, a slab, spliced to main frame at rear of back drivers, is generally used, and apparently with satisfactory results. The question of quickly and adequately draining cylinders, so as to overcome undue strains on frames and other parts of machinery, does not appear to have had the consideration it deserves; locomotive designers and builders should consider this matter carefully, particularly on piston-valve engines. The opening of cylinder cocks by hostlers and engineers, and leaving them open until cylinders are properly heated, should be insisted upon.

With cast steel, a design can often be used that would be impossible in wrought iron. Some of the trouble experienced with cast-steel frames has been due to the attempt to make them exactly the same as if of wrought iron, instead of taking advantage of the greater possibilities of designing and making a satisfactory frame where cast steel is used. Some designs of frames, such as those having ribs of different thicknesses, or pedestal fits of increased width, would be almost impossible to make of wrought iron. Very heavy frames over 5 in. in width are extremely difficult to make satisfactorily of hammered iron, and for these reasons cast steel appears to be the only suitable material.

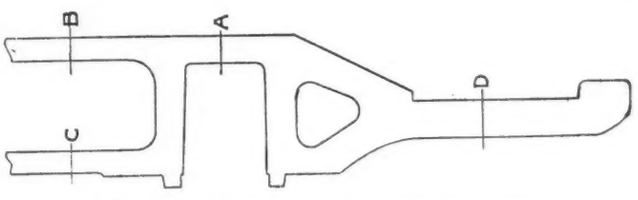
Herewith is a comparison of specifications suggested on page 406, in the 1904 Procedings, with those issued by the American Society for Testing Materials:

1904.	American Society for Testing Materials.
Tensile strength, 55,000 lbs. min.	60,000 lbs. min.
Elongation in 2 in., 15 per cent.	22 per cent. min.
Reduction in area, not specified.	30 per cent. min.
All frames to be annealed.	All steel casting to be annealed, unless otherwise specified.
Bending test, none specified.	A piece 1 by 1½ in., bent cold around a bar 1-in. diameter to 120 deg.
Size of test piece, none specified.	Specifically mentioned.
Test coupon, none specified.	To be attached to each frame for test purposes.

The committee suggests that, wherever possible, the specifications recommended by the American Society for Testing Materials be used, as a casting better suited to the requirements will be furnished. As an additional safeguard, it would be better to specify how frame castings should be annealed, and the following is recommended:

Steel-frame castings to be annealed must be heated uniformly to 850 deg. C. (1,500 deg. F.). The heat must be applied slowly, so that all castings in all parts of the furnace are approximately the same temperature. As soon as the castings have reached the required temperature the furnace may be opened.

It has been the observation of a prominent superintendent of motive power that on road engines going ahead, prac-



Calculated Sections of Locomotive Frame.

tically all of the time, the right frame breaks more frequently on the right-lead engine, and on left-lead engine the left frame is more susceptible to breakage.

The following aproximates rules will produce sections for

bar frames either in wrought iron or cast steel, suitable for modern locomotives:

A= T / 2,500 to 2,700	B= T / 3,000 to 3,200	C= T / 4,300 to 4,500	D= T / 1,600 to 1,800

T=Piston thrust (area of cylinder multiplied by boiler pressure).
A=Square inches of sectional area of frame, top of pedestals.
B=Square inches of sectional area of frame, top rail between pedestals.
C=Square inches of sectional area of frame, lower rail between pedestals.
D=Square inches of sectional area of frame, integral single rail at back cylinder-keying lug.

The width of frames is usually made in proportion to the weight and power of the engine. Frames of 6 in. are not uncommonly used for very heavy engines.

Most of the important bolts in a frame are vertical. Therefore it is often advisable to increase the width rather than make up the section entirely in depth, because the section is not cut away so much when large bolts are used, and for that reason, where 1⅜ or 1½ in. bolts are used, frames of greater width can be more economically employed than the narrower sections.

Frame breakages do not usually occur for some time after the locomotives are placed in service, and in a general way it may be stated that many breakages do not occur until the engines have been in service for at least two years. Probably three or four years is the time when the greater number of fractures commence to occur, and from that time on in increasing numbers.

PLATE FRAMES.

A more or less vague impression appears to exist in this country that plate frames are freer from breakage than bar frames. Plate frames are more readily repaired than bar construction, with the possible exception of thermit welds, because a plate on one or both sides can be bolted or riveted which will usually satisfactorily reinforce the broken section. On account of their relatively thin sections, plate frames in some instances are also repaired by means of oxy-acetylene blow-pipe welds. The general tendency in the design of railway rolling-stock is toward simplicity and the elimination of bolted parts, making or casting pieces together and working away as much as possible from built-up construction. Compared with the bar frame, which is used exclusively in the United States at present, plate frames are essentially a built-up construction, and in the erecting of an engine using such frames the alignment is much more difficult, involving more care and time, so that the erection of an engine is a longer process than when bar frames are used. This and other causes render plate-frame construction undesirable, as a possible substitute for bar frames.

Furthermore, it is a fact that the one-piece, integral-bar frame construction, when made of suitable material, is as free, if not freer, from defects or breakages than plate frames. From personal observation of a great many locomotives in the principal European countries and from reports obtained from railway men abroad, the facts seem to be that plate frames often break, especially on the older classes of engines, and that unless made exceptionally heavy above the pedestal they may be expected to show partial or complete fractures after a certain period of service.

One English railway reports that the frequency of broken plate frames is almost exactly ten per cent. per year.

It may be interesting to give extracts from an article written by Mr. I. Valenziani, of the Italian State Railways, published in *l'Ingegneria Ferroviaria* for November 1, 1910, which has a bearing on the subject. He says:

"Many European railways have purchased American locomotives, and among the details which were largely appreciated in Europe must be included the bar frames, which have two great advantages over the plate frames; namely, the very much greater ease of examination and adjustment of parts lying between the frames, and the greater ease and rapidity with which the various parts can be attached to the frames during the construction of the locomotives.

"In Europe bar frames are rather more expensive than plate frames to construct, and an extension of their use is attributable rather to this than to any technical reason."

As an interesting addition to the data contained in this paper, we herewith submit extracts from a report that was made by a representative of a locomotive company, who had been specially detailed to look into the subject of frame failure, but as a committee we do not agree with all his deductions.

"The number of frame failures which occur in the operation of locomotives in service is the cause of very serious delays, and represents at least twenty per cent. of the expenditures necessary to keep an engine in service.

"A comparison of the types of locomotives in service, which were built prior to the past three or four years, shows that the bracing of the frames has not been carried out as we now believe to be necessary for good service. In an effort to overcome the number of failures, the sections of frames have been made heavier and splices increased in section and bolting power, but with several exceptions the bracing of frames seems to have received less attention than it deserves. Experience shows that many engines with increased frame sections fail almost as much as they did with the lighter frames.

"The first conclusion is that a good design of bracing is more important than heavy frame sections. Another factor is the condition in which the engine is maintained, as shown by several of the detail reports by roads having engines of exactly the same design on different divisions, some of which give little or no trouble, while other divisions report trouble constantly.

"An investigation carried out on one road several years ago proved that the frame at first pedestal vibrated 1-16 in., both vertically and horizontally, and that in rounding a curve the bottom of the frame was deflected more than the top, which is the natural conclusion when we consider that the frames are usually braced only to the guide yoke, and knees at the top rail, and a light wrought-iron brace at the bottom rail. It is this twisting action on the frame which causes so many failures in the front leg of the first pedestal, and in the lower rails of the splice connections in consolidation engines, where the distance from the cylinder saddle to the pedestal is short. It seems to make no difference how heavy the frame rails are made, because if no other changes are made the frame will break just the same."

The report is signed by:—H. T. Bentley, (C. & N. W.), chairman; F. J. Cole (A. L. Co.), L. H. Fry (Baldwin), G. S. Edmonds (D. & H.) and E. D. Bronner (M. C.).

DISCUSSION ON BEST CONSTRUCTION OF LOCOMOTIVE FRAMES.

T. H. Curtis (L. & N.): I cannot give you any light on how to construct frames to keep them from breaking, but I will mention that the Louisville & Nashville have 150 consolidated locomotives with the *Stephenson* link motion. These locomotives were not troubled with frame breakage, but we built some fifty or more locomotives with the same frame, the locomotives are practically interchangeable, except that these last engines were equipped with the Walschaert valve gear. We have been troubled a great deal by the breaking of the left frame near the front pedestal, in the case of these engines. I have looked the engines over and cannot see any reason for the breaking of the frame. It breaks in a very strong place, and everything seems to be in a good condition, and I know that the engines are well kept up. In fact, the engines equipped with the Walschaert valve gear receive the same care as those equipped with the Stephenson link. Therefore, I attribute the trouble to the Walschaert valve gear. As to why it should cause this breakage of frames I cannot give any reason.

I will also say that of the engines that have the Stephenson link, that there were about 25 of them that had a very large plate bolted on the back of the cylinder and extended backward about four or five feet. We had a great deal of trouble with these frames breaking until we removed the plates, until we removed what made the frames stiff we had trouble.

In designing locomotive frames we have always used at least 2.5 in. of a lip on the bottom of the inside to hold the binder up tight. I think this is important, to hold the binder and the frames solid together, and it is necessary to stop the breakage of frames. I have found someone believed in the binding question to such an extent as to have the binding extend the whole length of the frame. As long as we have locomotives we will have the breakage of frames, as they will wear out, but I believe with proper bracing and care, by keeping the engine up, by giving it proper attention in the round house, we will save ourselves a great deal of the frame breakage.

H. T. Bentley: We have had a number of engines on our road, not very heavy, ten wheel freight engines, but have had a tremendous lot of trouble with the Stephenson Link engines breaking their frames, and we had a number of Walschaert valve gear engines, same general type and same size frame, but with the addition of cross bracing between the frames, and since that time we have not had a single case of frame breakage with that particular engine. It has been in service five or six years, and it would begin to show some difficulty, if difficulty was likely to be experienced.

We have an extract in our report from an engineer of the Italian State Railways. He is trying the plate frames, the bar frames, and he states conclusively that the bar frame has some advantages over the plate frame, namely, that it is easier to manufacture, more convenient to erect, very much easier for

inspection, and generally speaking the American Standard bar frame is preferable from every standpoint. I think where the committee has gone on record to say that a good deal of the trouble of frame breakage is absolutely preventable should lead the steel manufacturers to get together and see if they cannot do something to help the situation out. The use of cast steel for frames is very satisfactory, if we can get good steel castings, and get them properly annealed.

R. L. Ettinger (So.): We have a great many cast steel frames which have been satisfactory. Probably as many as 250 of the heavy engines have cast steel frames, with an alloy in them, and with these frames we have not had any breakage at all. Some of the simple engines have had the frames broken. We have not had any epidemic of broken frames.

E. W. Pratt (C. & N. W.): How long have the 250 frames been in service?

Mr. Ettinger: About six years, the oldest of them. The first, I think, we got about six years ago.

Wm. Forsyth (*Railway Age Gazette*): Since the committee has come out definitely in favor of cast steel frames, it seems to me that there ought to be a good specification for the casting, just as Mr. Bentley said. This specification of 1904 is for a low-strength steel. It is a steel whose chemistry and strength correspond very closely with ordinary boiler steel. It is soft. The committee further recommends as preferable to this the specification of the American Society for Testing Materials, which has a strength 5,000 lbs. greater. Now, that specification of the American Society for Testing Materials is one which applies to steel castings generally. It is not specially for locomotive frames, and I believe it would be a good idea if the association was to request the American Society for Testing Materials to investigate this subject and have a committee frame a special specification for cast steel locomotive frames and present it to this association. If it is in order, I will make that as a motion.

The motion carried.

R. D. Smith (B. & A.): We have had considerable trouble with steel frame breakages on consolidation type engines with narrow fire-boxes, and we have lately come to the conclusion that the trouble has been not so much in the vertical stresses as the horizontal stresses, due perhaps to the long overhang and the fact that the breakages all occurred through the bolt holes. It is usual, when we have troubles of that sort, to think if we had a little more material in the frame it would be better, and we have added a little more material top and bottom, and we have gone to adding some on the side, to better bracing, and we have used the frame as recommended by the committee. Just what the results of this will be we do not know yet, because we have just changed our patterns and ordered our first set of frames which have been strengthened in this way, but it has been my thought that the failures were caused by the horizontal stresses due to the swinging, as well as the horizontal stresses due to the excessive overhang in some of these frames. I quite agree with what Mr. Forsyth has said, that we should have some specifications for steel for frames, and we have also gone over the rules as recommended by the committee on page nine, and we quite agree with them.

J. Christopher (T. H. & B.): It would appear that the question of the quality of the steel is the chief point. It occurred to me it would be a good idea for them to determine the radius of the gillets at the pedestals and consider those points, in making their recommendations, as well as the quality.

C. A. Selev (C. R. I. & P.): The most perplexing frame breakage which has occurred to us lately is in the forward pedestal on the Pacific type engine, new engines, massive frames, massive binders, everything put up in good shape, and we have had a number of breakages starting from the rods, extending upward, a perfectly straight break, through to the inside of the jaw, through six or eight inches of solid metal, apparently. It is a perfectly clean break. Why they should break, I cannot figure out.

R. D. Smith: I believe that a well designed steel frame will not break if the boxes, wedges and shoes are kept up. If more attention is given in the roundhouse to keeping up these features that go to hold our frames together, like the binders and bracing, we will not have so much trouble with them.

B. P. Flory (N. Y. O. & W.): We have a lot of fifteen simple engines, and in the case of every one of these engines we have had broken either one or both of the frames on the top rail underneath the rocker bars. We came to the conclusion that the cause of the frames breaking was the probability of their not being sufficiently braced. They did not have the frame bracings on the bottom rail at all, and we put one on there and since that time we have not had any of them break.

I was very glad to see the committee recommend the cast steel one-piece frame. I note, however, on page 7, that the committee says, "But on slide-valve engines it is usually necessary to resort to a two-piece frame, because of lack of strength at cylinders." That has not been my experience, as for probably four or five years I have used the one-piece cast steel frame in the slide valve cylinders and have had practically no difficulty with it.

E. W. Pratt (C. & N. W.): If there are any of the members who find it necessary to make a two-piece frame, a vertical splice would give very much less trouble from breakage than a horizontal splice. The splicing bolts at that point give us a great deal of trouble, and I have heard others say the same.

Mr. Chambers (C. of N. J.): We have not had any trouble at all, which you would term serious, in frame breakages for several years. We had a type of twelve wheel locomotive 105 tons, and it gave a great deal of trouble from frame breakages right over one box, but we designed a cast steel section, cut off back and forward of the pedestal, and have had no trouble with the rest of the frame anywhere. Out of possibly fifty-one locomotives, we may have had 35 breakages on the right side, and may have had only one on the left, so it was not necessary to put a cast steel section on the left side.

We have ten heavy locomotives, equipped with the Walschaert gear, which have been in service, I think, for about four years. We have not had any frame breakages in any of these engines, and I was a little surprised to hear Mr. Curtis say that in his opinion the Walschaert gear had anything to do with the trouble. I think more than likely it is due to frame construction. These engines had better frame bracings than the link motion engines. That might have had something to do with it.

T. H. Curtis: I ask Mr. Chambers if the engines were both framed on the right hand side? I wish to call attention to my remarks to the engines with the Walschaert gear, in which the frames were broken, that it was only the right hand frame in these engines which were broken, and not the left.

Mr. Chambers: These were in all cases the right hand lead.

C. D. Young (Penn.): We had a great deal of trouble with the breaking of frames on consolidation locomotives, the same size as Mr. Chambers' engines to which he referred. They were equipped with the Stephenson gears. On the lines West I think there were about 400 engines, and the frame breakages ran up to over a thousand. We followed them in 1906 with the outside gear engine, identical in every respect, excepting the gear, frames the same section, but being cross braced, the idea being to carry the cross bracing back from the cylinders just as stiff as you could to the ash pan, and outside of manufacturers' defects and poor castings, I believe we have not had a broken frame which could be attributed to poor construction. I believe that the Walschaert valve gear has solved half of the broken frame trouble, because you can cross brace frames making a rigid structure back of the cylinders, and tie the two frames together, reducing the lateral vibration.

Mr. Pratt suggested the vertical splicing in preference to the horizontal splicing. We had so much trouble on the first consolidation engines that we made a number of experimental designs to increase the horizontal splice. That did not seem to do much good. The frames still broke, it simply carried the break a little further back. Most of the earlier breaks were right at the splice, ahead of the front driving box, and when we increased the weight of the splice, it went over back in the frame and broke over the front driving box, or between the front driving box and the intermediate wheel. We built the splice ahead of the front drivers, a vertical splice, using about twenty-four short bolts. We have about twenty of these engines running, they have been running about three years, and none of the frames have broken.

J. F. Enright (D. & R. G.): We are not experiencing the trouble with broken frames which the other roads seem to be. It is possibly due to the fact that our engines come in for class repairs oftener than engines operated on level roads. Our three, four and five engine trains make the operation severe on the engine, or the engine ahead of the train engine. Judging from our experience, the one-piece frame for the piston valve engine, is in my opinion the best design of frame that has been put on a locomotive. We have a number of that design in passenger service with the Walschaert gear, and with one exception I do not recall a broken frame on these engines. And that exception was the main pedestal, just about midway between the binder and the top of the frame, at the back end or the wedge side.

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T. Rumney (Erie): We have tried to do everything that has been recommended by the Association from time to time, and we have conferred with the builders of locomotives in making various designs, to strengthen up and stiffen up the frames in every way that they could. We have put in large fillets, used single frame—that is, the one-piece frame—and endeavored to brace the frames as much as possible. We have some engines running that have not broken a frame in two years, and we have some types of engines running that have not broken over two or three frames in about thirty engines in about four years, but on the same type of frames, on other engines with cast steel frames have broken, so that it is pretty hard to determine where we do stand. We have some alloy frames with vanadium that have run, one for four years and no trouble, and no trouble, either, with the engines built at the same time with cast steel frames—apparently we have not reached the point in the case of these engines where the breakage is likely to occur.

C. E. Chambers: I would like to add a word for the benefit of the members—on those engines in which we had the frames break, the front wheel type of engine, the frame broke just forward of the jaw. We had a splice just in front, before it touched the jaw. After a time we used a cast steel section, using the same kind of splice, and since then, about a year ago, we went further ahead, just back of the cylinder and cut-off where the frame is a single bar and made the section cover that point, and we have a one-piece frame, which has been very successful, doing away with the trouble of splicing the top.

A. E. Manchester (C. M. & St. P.): I do not see any difference between the serviceability of the iron and steel frames. We have 175 consolidation engines with 56-in. wheels. The first few years that these engines were in service they were kept entirely in a moderately slow speed, but very heavy service, the engines hauling from 3,000 to 5,000 ton trains. Later on a condition developed due to the particular weight and length of these engines, and we had to transfer them to another district where the speeds were high. In the slower heavy service we had practically no broken frames at all, but when we turned the engines over to the fast service we had a great many broken frames. We cannot entirely balance the engine according to rule, and I believe that that was one of the things that caused the trouble with these engines, the matter of gravity and high speeds.

The President: I wish to say that we have had a lot of trouble with broken frames. Most of our troubles have been with Pacific type engines. We have had consolidated engine frames break, but I do not think it makes very much difference whether they are running on a division of 200 miles, with tangent track, or on a division that has no tangent track; it seems to be about the same thing. The breakage occurred mostly in the top rail either under the guide yoke or at the pedestal or even up close to the cylinder—we have extended the top rail of the frame back from the rear of the front pedestal far enough to get it solid in back of the back leg. We have done away with the guide yoke bracket entirely, making the frame, the leg on it, as a guide yoke bracket. We have forty engines; it is true they are lighter engines and have smaller wheels, which have been in service twelve years, and we have not a record of a broken frame.

We commenced changing the Pacific type of engines to this design about two and a half years ago. We have not had a broken frame on the Pacific type of engine as equipped with this frame. We feel that the guide yoke bracket, about twenty inches high, to get the guide yoke up high enough with the cast iron bracket bolted, which was not always tight, but was frequently loose, was largely responsible for the trouble which we had.

R. W. Bell (Ill. Cent.): About ten years ago on the Illinois Central we had a great many frame breakages, and we started a systematic campaign to ascertain the way in which our engines were taken care of in the roundhouse. We found that our frames broke on the ends that were neglected, wedges that were down, wedges that were not kept in condition, brasses not taken care of, and we started a campaign of education of our roundhouse force, and after we introduced better methods of caring for the engines, our frame breakages were reduced to a minimum. I think the greatest causes of frame breakages are loose wedges. It is true, that the design of the frame has something to do with it, but I think if the engine is kept up in a state of high efficiency, all the rods and boxes in proper order, you will find that the frame breakages will be greatly reduced. That is our experience. We have 1449 engines, and since last July our frame breakage has been one per cent.

D. J. Reding (P. & L. E.): We had a lot of consolidation locomotives in which the frames broke at the head of the front jaw, and we came to the conclusion that the principal reason was that they had a light sheet, running from the guide yoke up to the boiler, and it was fastened against the boiler, and we would always find the bolts tieing this sheet to the guide yoke and the boiler loose on the frame of the yoke. By putting in double sheets and double anchors against the boilers and putting in a cast iron section between the top and bottom rail, ahead of the front jaw, to take up the vibrations set up by the piston thrust at the back end of the guides, we nearly eliminated the breakage of these frames, and it seemed to me if anything could be added to the report of the committee it would be some suggestion as to the proper bracing.

George W. Rink (C. of N. J.): I believe the bracing is an important part of the locomotive. I have an idea that sufficient metal is not applied vertically to the bolt holes in the braces. Where you find a bolt with anywhere from three-quarters of an inch to one inch of metal through the bracing, the same should have at least an inch or an inch and a half of metal, and the frame bracing should extend from the top rail to the lower rail, so as to brace cross-wise, in other words, use a brace in the shape of the letter X. I believe that would be far preferable to using a large flat brace lying on the top rail. We have found occasion to apply to engines originally built with such a brace an additional brace to the lower rail and extending a sheet from the top frame casting to the lower additional bracing. What I have just described applies principally to the front furnace supports.

I believe the use of a sheet connecting the mud ring into the supporting casting is a good idea. As far as the thickness of the sheet is concerned, I believe the thinner the sheet is the better, as far as flexibility is concerned. My attention was called the other day to an eight wheel engine that had the front jaws broken on both sides. This engine had a frame of about four by seven. It had no underhung springs. The wedge required lining up and it was neglected, and I can attribute the cause of that breakage to the fact that the wedges were not properly lined up.

We have a large number of cast steel frames in service, a number of frames made of .40 per cent. carbon steel, introduced on our latest switching engines, and as far as these switching engines go we have had no trouble. The particular engine Mr. Chambers referred to had a cross spring from one driver box to the other, and the frame was cut out a trifle on an angle, which weakened the frame at that point. When we got out the new cast steel section we added two inches to the depth of the frame at that point, and have had no trouble.

H. T. Bentley; I agree with Mr. Bell, of the Illinois Central, and Mr. Seabrook, of the St. Louis Southwestern, who report having had no trouble, due to getting a better grade of steel. It has been stated to me that the committee has done an injustice to the vanadium steel frames, insofar that we did not state how many frames were in service when we stated how many were broken, and to try to straighten that out I will try to give the result of the information I got at the time this report was compiled: One set, none broken; five sets, none broken; one set, none broken; three sets, one broken; one Mallet, four frames, none broken; three sets, none broken; two hundred and thirty sets, none broken.

Mr. Chambers spoke of the one piece frame eliminating the splice. I think that is the *European* practice. Everyone knows what troubles they have had with splices, and they have gone into the practice of making sections and welding the section in the center of the front jaw, and I think it is a good thing to do; that is the practice we are using.

COMPLAINTS.

The committee on arrangements announces that it will be glad to undertake to adjust all complaints of any nature during the conventions. The committee is composed of E. L. Adreon, chairman; C. E. Fuller and T. H. Curtis. Its office is with the secretary of the Railway Supply Men on the Million Dollar Pier.

RAILWAY CLUB SECRETARIES.

The annual meeting of the Society of Railway Club Secretaries will be held at the Hotel Brighton, at 10 o'clock Saturday morning. The dinner will be held at 7.30 in the evening in the garden of the Hotel Windsor, unless the weather is unfavorable, in which case it will be held inside. There will be no past-prandial oratory, but a special programme is being prepared.

THE M. M. RECEPTION LAST NIGHT.

The annual reception by the officers of the Master Mechanics' Association was given in the Blenheim Exchange, Marlborough-Blenheim Hotel, last night, and was attended by a large crowd. President and Mrs. Fuller headed the receiving line. The Southern Singers, a quartette of young women, gave a concert thirty minutes before the receiving line formed, and following the reception there was informal dancing. Two orchestras furnished the music, and punch was served in the west solarium.

The receiving party was as follows: Mr. and Mrs. C. E. Fuller; Mr. and Mrs. H. T. Bentley; Mr. and Mrs. T. Rumney; Mr. and Mrs. A. Sinclair; Mr. and Mrs. T. H. Curtis; Mr. D. R. MacBain and Miss MacBain.

The ladies of the party were gowned as follows: Mrs. Fuller, white bordered satin; carried white roses; Mrs. Bentley, black silk trimmed with jet; carried orchids; Mrs. Rumney, white chiffon embroidered in blue; carried lilies of the valley and pink pea roses; Mrs. Sinclair, gray satin with point lace; carried pink carnations; Mrs. Curtis, chantilly over yellow satin; and Miss MacBain, blue marquisette hand-embroidered with pink roses; carried pink roses. The reception was probably the most successful that has been held at Atlantic City. The reception sub-committee was composed of Edward S. Toothe, chairman; F. B. Ernst, C. A. Dunkelberg, Frank Martin, George R. Carr and Herbert Green.

BALL GAME RESULTS IN FORMER YEARS.

The ball game has been an annual event since 1903, and of the eight games that have been played six have been between east and west. This year, on next Saturday afternoon, for the seventh time east and west will meet on the diamond, and it is interesting to glance back over the scores that have been made in past years. They are as follows:

	West	East
1903	5	11
1904	11	7
1905	17	18
1906	17	7
1907	23	1
1910	0	15

It will be seen that each section has won three games. The games in 1908 and 1909 were between the railway men and the supply men. In 1908 the supply men won, 25 to 19; in 1909 the railway men won, 14 to 12.

The most exciting game in the series was that in 1905, when the score was 18 to 17.

THE BAND MYSTERIOUS.

J. Will Johnson, chairman of the entertainment committee, seems to understand the advantages of shrouding in mystery certain features of the entertainment program until the pyschological moment arrives for letting them burst forth in all their glory. He is understood to have a supply man's brass band concealed about his person somewhere, which has been practicing regularly since last year's conventions, but he refuses to let it be seen or heard, or to disclose the identity of its membership until it shall take its place in the parade to the base ball grounds Saturday afternoon. It is said to have been tuning and tooting somewhere in Atlantic City Tuesday night, but Mr. Johnson evidently keeps it in a noise-proof room. Some knockers say it has taken all year for the bloomin' bunch to learn ten pieces, and that the chairman is keeping it locked up for fear it will give its program prematurely and be unable to repeat on Saturday. Perhaps the fact is that he thinks if he did not refuse to let it play now, the rest of the convention crowd would refuse to let it play Saturday.

M. M. REGISTRATION.

Appler, A. B., M. E., Delaware & Hudson Co., Marlborough-Blenheim.
Arden, D. D., M. M., Savannah & Slatsbro, Baltimore.
Arp, W. C., S. M. P., Vandalia R. R., Marlboro.
Ayers, A. R., M. E., L. S. & M. S. R. R., Shelbourne.
Basford, Geo. M., Associate, American Locomotive Co., Marlborough-Blenheim.
Bawden, Wm., M. M., Terminal R. R. Assn. of St. L., Watkins.
Bayley, J. J., M. M., Southern Ry., Sterling.
Bean, S. L., M. S., A. T. & S. F. Ry., Marlborough-Blenheim.
Bell, R. W., Supt. Mach., Ill. Central R. R., Dennis.
Bennett, W. H., M. M., Penna. R. R., Traymore.
Blunt, James G., Supt. Gen. Draw. Rm., Amer. Loco. Co., Traymore.
Booth, J. K., Gen. For., Bessemer & Lake Erie R. R., Traymore.
Booth, J. S., M. M., Carolina & N. W., Ten Eyck.
Bowden, J. F., M. M., Balto. & Ohio R. R., Elberon.
Bowles, C. K., Tidewater & Western R. R. Co., Sterling.
Brown, M. G., M. M., Gulf & Ship Island R. R., Haddon Hall.
Burk, C. H., Loco. Supt., Mexican Ry., Shelbourne.
Burton, T. L., Gen. Insp., P. & R. R. R., C. R. R. of N. J., Marlborough-Blenheim.
Butler, F. A., M. M., B. & A., Young's.
Chambers, C. E., S. M. P., C. R. R. of N. J., Dennis.
Chidley, Joseph, M. M., Lake Shore & Mich. Southern Ry., Marlborough-Blenheim.
Christopher, Jacob, M. M., Toronto Hamilton & Buffalo Ry., Young's.
Cory, C. H., Honorary Member, Dennis.
Cole, F. J., C. C. E., American Loco. Co., Traymore.
Cox, R. G., M. M., Virginia & Southwestern Ry., Haddon Hall.
Cromwell, Oliver C., Marlborough-Blenheim.
Cross, C. W., Supt., App., N. Y. C. Lines, Traymore.
Curtis, Theo. H., S. M., L. & N. R. R., Marlborough-Blenheim.
Darlow, A . M., M. E., B. & S., Marlborough-Blenheim.
Davis, John E., M. M., Hocking Valley, Monticello.
Deeter, D. H., M. M., Phila. & Reading Ry., Jackson.
Dillon, S. J., M . M., Penna. R. R. Co.
Dooley, Wm. H., S. M. P., C. N. O. & T. P. Ry., Dennis.
Dow, Geo. N., C. M. I., L. S & M. S. Ry., Chalfonte.
Duffey, G. J., M. M., Lake Erie & Western Ry., Marlborough-Blenheim.
Dunham, W. E., Supvr., M. P. & M., Haddon Hall.
Dunn, Jas. F., S. M. P., Oregon Short Line R. R., Chalfonte.
Eden, E. S., M. M., Central New England Ry. Co., Rudolph.
Elliott, J. B., M. M., Balto. & Ohio R. R., Elberon.
Enright, J. F., S. M. P., Denver & Rio Grande R. R., Chelsea.
Endsley, Prof. L. E., Asso. Prof. Mech. Engineering, Purdue University, Chalfonte.
Figner, W. H., M. M., Central of Georgia Ry., Chalfonte.
Fitzsimmons, E. S., M. M., Erie R. R., Schl'tz.
Flavin, U. J., M. M., C. I. & S. R. R., Marlborough-Blenheim.
Fowler, Geo. L., Dennis.
Franey, M. D., A. M. M., L. S. & M. S. Ry., Marlborough-Blenheim.
Fulmor, John H., M. M., Penna. R. R., Pennhurst.
Garstang, Wm., S. M .P., C. C. C. & St. L. Ry., Marlborough-Blenheim.
Gentry, T. W., American Loco. Co., Wiltshire.
Goodrich, Max, G. F., New York & Ottawa R. R., New Holland.
Gordon, H. D., Marlborough-Blenheim.
Graburn, A. L., Mech. Engr., Can. Northern, Young's.
Green, Herbert, M. E., Brighton.
Greenwood, B. E., G. F., Seaboard Air Line Ry., Windsor.
Haig, M. H., M. E., A. T. & S. F. Ry., Traymore.
Hainen, J., S. M. P., Southern Ry., Dennis.
Hale, H. H., M. M., C. H. & D. Ry. Haddon Hall
Harrigan, P. J., M. M., B. & O. R. R., Chetwoode.
Harris, C. M., M. M., Washington Terminal R. R., Traymore.

Haug, Harry, M. M., Brownstone & Middleton Ry., De Ville.
Hawkins, R. D., M. E., Great Northern Ry.
Hayes, W. C., Supt. Loco. Op., Erie R. R., Chalfonte.
Hayward, H. S., S. M. P., Penna. R. R. Co., Chalfonte.
Henry, W. C. A., S. M. P., Penna. Lines West, Chalfonte.
Hess, Geo. F., M. M., B. & O. R. R., Dunlop
Hill, Rufus, Ex. M. M., P. R. R. 1504 Pacific Ave.
Hill, W. H., M. M., Cornwall R. R., De Ville.
Hodgins, Geo. S., Man. Edit. Ry. and Soc. Engineering, Haddon Hall.
Hoffman, C. M., S. M. P., St. L., Brownsville & Mexico Ry.
Hoffmaster, F. S., A. M. M., N. Y. P. & N. R. R., Westminster.
Horsey, A. W., M. E., Can. Pac. Ry., Haddon Hall.
Huber, H. G., Asst. M. M., P. R. R., Chalfonte.
Hunter, H. S., M. M., Phila. & Reading Ry.
Jackson, O. S., M. M., Chgo, Terre Haute & So. Eastern Ry., Dunlop.
James, Charles, M. M., Erie R. R., Slitz.
James, J. M., M. M., Penna. R. R., Marlborough-Blenheim.
Jaynes, R. T., M. M., Lehigh & Hudson River Ry., Traymore.
Joughins, G. R., M. S., Colonial Ry., Chalfonte.
Kadie, C. H., M. M., Southern Ry.
Keenan, C. E., M. M., N. Y. C. Lines, Strand.
Kiesel, W. F., Asst. Engr., Penna. R. R. Co., Chelsea.
Kinney, C. D., M. M., Kanawha & Michigan Ry., Traymore.
Kinney, M. A., S. M., Hocking Valley Ry., Traymore.
Kirkpatrick, James, M. M., B. & O. R. R. Co., Elberon.
Knight, W. Edward, S. M. P., Cuba R. R., Pennhurst.
Kyle, C., M. M., Canadian Pacific Ry., Haddon Hall.
Lovell, Alfred, Traymore.
MacBain, D. R., S. M. P., L. S. & M. S. Ry., Marlborough-Blenheim.
MacDowell, Wm. G., 1st V. P., Norfolk & Western Ry., Dennis.
McGuire, J. J., Gen. For., B. & O., La Balle Inn.
McIlvaine, C. L., Asst. Engr. M. P., Penna. R. R. Co., Chalfonte.
MacKenzie, John, Dunlop.
McLean, J. E., M. M., Kansas City So., Dennis.
McNaughton, Jas., Amer. Loco. Co., Marlborough-Blenheim.
McNulty, F. M., S. M. P. & R. S., Monongahela Connecting R. R., Chalfonte.
McPherson, T. J., M. M., Peoria & Pekin Union Ry.
Mathis, J E., M. M., Georgia & Florida R. R., Dunlop.
May, H. C., M. M., L. & N. R. R., Chalfonte.
May, Walter, M. M., C. C. C. & St. L. Ry., Chalfonte.
Maxfield, H. H., M. M., Penna. R. R., Chalfonte.
Minshull, P. H., M. M., N. Y. O. & W. R. R. Co., Traymore.
Meister, C. L., M. E. (Ch. Draftsman) Atlantic Coast Line, Shelbourne.
Moll, George, M. M., Phila. & Reading R. R., Jackson.
Murray, F. H., M. M., Erie R. R., Pt. Jervis, Lexington.
Nash, J. H., Shop Supt., Ill. Cent. R. R., Hadon Hall.
Needham, H. S., A. E. M. P., Penna. Lines, Haddon Hall.
Owens, W. H., Southern Ry. Co., Sterling.
Page, C. N., M. M., L. Valley, Auburn, N. Y., The Silverton.
Passmore, H. E., M. M., T. & O. E. Ry., Chalfonte.
Pearce, J. S., M. M., Norfolk & Western Ry., Chelsea.
Perrine, W. M., M. M., Central R. R. of N. J., Penhurst.
Pffafflin, Louis. M. M., Indianapolis Union Ry., Biscayne.
Pilcher, John A., M. E., Norfolk & Western Ry., Traymore.
Plank, P. D., M. M., Louisville Henderson & St. L. R., Windsor.
Prendergast, A. P., M. M., Balto. & Ohio R. R., Shelburne.
Purvis, T. B., Jr., Young's.
Querean, C. H., N. Y. C. & H. R. R. R., Traymore.
Quigley, Joseph, M. M., C. & G. S. Ry., Dennis.
Redding, D. J., Asst. S. M. P., Pittsburgh & Lake Erie R. R. Co., Traymore.
Reid, W. L., Gen. Wks. Mgr., Am. Loc. Co., Marlborough-Blenheim.
Reynolds, O. H., Dennis.
Riley, Geo. N., National Tube Co., Marlborough-Blenheim.
Rink, Geo. W., M. E., C. R. R. of N. J., Dennis.
Rogers, Robert Hunter, Gen. Insptr., Erie R. R., Rudolph.
Rollings, E. O., M. M., L. & N. R. R., Westminster.
Rose, W. G., M. M., C. H. & D., Watkins.
Rumney, Thos., M. S., Erie R. R., Holmhurst.
Schlafge, Wm., M. M., Erie R. R., Schlitz.
Schmidt, Prof. E. C., Haddon Hall.
Sechrist, T. O., M. M., C. N. O. & T. P. Ry., Dennis.
Seddon, C. W., S. M. P. & C., D. M. & N. Ry., Traymore.
Sinclair, Angus, Editor Loco. Engineering, Haddon Hall.
Sinnott, W., M. M., Baltimore & Ohio R. R. Co., Pennhurst.
Slayton, C. E., M. M., Asst. Supt., St. Joe & Grand Island Ry.
Slayton, F. T., S. M. P., Virginia Ry.
Sneck, Harry, M. M., Buff. Roch. & Pitts. R. R.
Snell, E. J., M. M., N. Y. C. & H. R. R. R., Pennhurst.
Sprowl, N. E., M. M., Atlantic Coast Line R. R., Young's.
Staley, H. F., M. M., Caro, Clinchfield & Ohio Ry., Traymore.
Stewart, A., M. S., Southern Ry., Marlborough-Blenheim.
Storey, J. W., C. D., Cent. of Ga. Ry., Berkshire.
Stuart, Charles M., M. M., Phila. & Reading R. R., Penhurst.
Stubbs, G. W., M. M., Gulf Line Ry., Arlington.
Sweeley, E. H., G. F. L. R., Long Island R. R., Haddon Hall.
Swoyer, H., M. M., Rogers Loco. Wks., Traymore.
Tawse, Robt., S. M. P., Detroit, Toledo & Ironton Ry., Iroquois.
Taylor Wm. H., M. M., N. Y. S. & W. Ry. Co., Dennis.
Thayer, F. C., G. R. F. E., Southern Ry., Penhurst.
Thomas, H. T., M. M., Detroit & Mackinac R. R., Penhurst.
Thomas, W. H., Honorary Member, Dennis.
Trumbull, A. G., M. S., Erie R. R., Chalfonte.
Tuma, Frank, M. M., Erie R. R., Traymore.
Turner, Calvin G., M. M., Phila., Balto. & Wash. R. R. Co., Chalfonte.
Van Buskirk, H. C., S. M. P., C. & S. Ry., Chalfonte.
Van Doren, G. L., Supt. Shops, Cent. R. R. of N. J., Dennis.
Wagstaff, Geo., Amer. Arch. Co., Chalfonte.
Walsh, Frank J., G. F., Ches. & Ohio Ry., Marlborough-Blenheim.
Warthen, H. J., M. M., Washington Southern Ry., Sterling.
Watts, A. H., M. M., Cincinnati Northern R. R., Dennis.
Watson, R. B., Engr. of Tests, Erie R. R., Traymore.
Watters, J. H., Asst. M. M., Georgia R. R., Traymore.
Wells, M. E., A. M. M., Wheeling & Lake Erie R. R., Mt. Vernon.
Wells, Reuben, Ex-Pres. M. M. Assn., Dennis.
Wildin, G. W., Mech. Supt., N. Y., N. H. & H. R. R. R., Chalfonte.
Wilson, Charles, M. M., Lehigh Valley R. R., Alberon.
Wood, L. L., S. M. P., E. & T. H. R. R., Youngs.
Wright, R. V., Mech. Dept., Editor R. R. Age Gazette, Chalfonte.
Whyte, F. M., New York Air Brake Co., Marlborough-Blenheim.
Young, C. B., M. E., Chgo., B. & Q. R. R., Traymore.
Young, Charles D., A. E. M. P., Penna. Lines, W., S. W. System, Brighton.

M. C. B. REGISTRATION NOTICE.

Secretary Taylor announces that arrangements have been made for registering the members of the M. C. B. Association any time this week, instead of waiting until next week.

M. C. B. REGISTRATION.

Anderson, Geo. T., Supt., N. Y. Desp. Ref. Lines, Chalfonte.
Appler, A. B., M. E., Dela. & Hudson Co., Marlborough-Blenheim.
Arp, W. C., S. M. P., Vandalia R. R., Marlborough-Blenheim.
Baron, Jacob, Kentucky & Indiana Bridge & R. R. Co., Young's.
Beamer, James A., M. M., Penna. R. R., Chalfonte.
Bell, R. W., Supt. Mach., Ill. Cent. R. R., Dennis.
Baker, J. E., Past Pres. M. C. B., Chalfonte.
Burton, T. L., Gen. Insp., C. R. R. of N. J., Marlborough-Blenheim.
Chamberlain, J. T., Life Member M. C. B., Young's.
Chambers, C. E., S. M. P., Cent. R. R. of N. J., Dennis.
Christopher, J., M. M., Tor. Ham. & Buff. Ry., Young's.
Combs, S. W., Master Car Bldr., Cuba Railroad Co., Traymore.
Combs, W. B., M. M., Macon, Dublin & Savannah R. R., Young's.
Cromwell, O. C., M. E., Balto. & Ohio R. R., Marlborough-Blenheim.
Curtis, Theo. H., S. M., Louisville & Nashville R. R., Marlborough-Blenheim.
Dillon, S. J., M. M., Penna. R. R.
Dunn, J. F., S. M. P., Oregon Short Line R. R., Chalfonte.
Edenk, E. S., M. M., Cent. New Eng. R. R. Co., Rudolph.
Enright, J. F., S. M. P. & C. D., Denver & Rio Grande R. R., Chelsea.
Fowler, Geo. L., Dennis.
Garstang, Wm., S. M. P., C. C. C. & St. L. Ry., Marlborough-Blenheim.
Goodrich, Max, M. M., New York & Ottawa R. R., New Holland.
Grewe, H. F., Wabash, Pittsburgh Terminal Ry., De Lamar.
Hainen, J., S. M. P., Southern Ry., Dennis.
Hayward, H. S., S. M. P., West Jersey & Seashore R. R., Chalfonte.
Henry, W. C. A., S. M. P., Penna. Lines West, Chelsea.
Hill, Rufus.
Hoffman, C. M., S. M. P., St. L. B. & Mex.

James, J. M., M. M., Olean Shops, Penna. R. R. Co., Marlborough-Blenheim.
Joughins, G. R., S. M. P., Intercolonial Ry., Chalfonte.
Kadie, C. H., M. M., Southern Ry., Pennhurst.
Kiesel, W. F., Jr., Asst. M. E., Penna. R. R., Chelsea.
Knight, W. Edward, S. M. P., Cuba R. R., Pennhurst.
McNulty, F. M., M. M., Monongahela Connecting R. R., Chalfonte.
Needham, H. S., A. E. M. P., Penna. Lines, Haddon Hall.
Passmore, H. E., M. M., Toledo & Ohio Central Ry., Chalfonte.
Pilcher, John A., M. E., Norfo.k & Western Ry., Traymore.
Pfafflin, Louis, M. M., Indianapolis Union Ry., Biscayne.
Purves, T. B., Jr., Youngs.
Rink, Geo. W., M. E., Central R. R. of N. J., Dennis.
Robider, W. J., M. C. B., Central of Georgia Ry., Chelsea.
Schroyer, C. F., M. C. B., C. P. & W. R. R., Young's.
Schmoll, G. A., S. M. P., Baltimore & Ohio R. R., Traymore.
Seddon, C. W., S. M. P. & C., Duluth, Missabe & Nor. Ry., Traymore.
Simpson, Porterfield, Supt. of Equipment, Indiana Refining Co., Chetwood.
Sinclair, Angus, Ed'tor, Locomotive Engineering, Haddon Hall.
Slayton, C. E., C. E., Asst. Supt., St. J. & G. I. Ry.
Slayton, F. T., S. M. P., Virginian Ry.
Stewart, A., G. S. M. P. & E., Southern Ry., Marlborough-Blenheim.
Tawse, Robt., S. M. P., D. T. & I. & Ann Arbor R. R., Iroquois.
Thomas, H. T., M. M., Detroit & Mackinac Ry., Pennhurst.
Van Buskirk, H. C., S. M. P., Colorado & Southern Ry., Chalfonte.
Wildin, G. W., Mech. Supt., N. Y. N. H. & H. R. R., Chalfonte.
Wood, L. L., S. M. P., E. & T. H. R. R., Young's.
Wright, R. V., Mech. Dept. Editor, R. R. Age Gazette, Chalfonte.
Young, Charles D., A. E. M. P., Penna. Lines West, Brighton.
Young, C. B., M. E., C. B. & Q. R. R., Traymore.

GUESTS.

Adams, T. S., Atlantic City & Shore Line, New Hampshire.
Alterman, J. N., Atlantic City & Shore Line Ry., New Hampshire.
Allman, Wm. H., Draftsman. B. & O., Kenderton Hall.
Avis, S. H., D. & A. Telephone Co.
Ayars. C. P., Printer, Lorrain.
Bechold, Dudley, Supt., Young's.
Bellingham, Jos., Traymore.
Benton, F. H., Draftsman, A. C. & S. L., Traymore.
Bew, James W.
Borup. O. V.. Draftsman. B. & O.. Kenderton.
Bisworth, W. M., Draftsman, B. & O., Kenderton.
Cadwell, Rev. N. W., Atlantic City.
Calkins, A. E., Asst. to S. R. S., N. Y. C. & H. R., Young's.
Carey, W. S., Secy. to S. M. P., P. R. R., Russell.
Chambers, Jas. A., Dennis.
Christopher, Byron, Young's.
Christopher, Thomas, Young's.
Carfield, W. D., Agt., Phila. & R. Ry.
Cozad, Wm., Shop Specialist, Erie, Schlitz.
Craven, G. W., Supt. Schofield Iron Wks., Chalfonte.
Cromwell, J. E., Inspector, B. & O., Kenderton.
Cromwell, H. C., Draftsman, B. & O., Kenderton.
Currier, H. C., Ch. Clk., Pa. Mich. Cent., Young's.
Darlow, A. M., Me. Engineer, B. & S. Ry. & Ry., Marlborough-Blenheim.
Davis, J. E., M. M., C. Col. O. Hocking Valley, Monticello.
Davis, M. J., Asst. M. M., P. R. R., Chalfonte.
Degnan, T. S., D. & H., Edgewater.
Dittoe, W. P., Pur. Agt., N. Y. C. & St. L., Chalfonte.
Dooley, F. A., Asst. Road Foreman & Eng., N. Y. C. & H. R., Islesworth.
Doolittle, R. L., S. M. P., A. B. & A. R. R., Young's.
Dunham, Geo. S., M. P. & M. Ry., Haddon Hall.
Ehney, W. S., Local Agent, M. D. & S. R. R., Young's.
Endicott, Paul D., 123 State Ave.
Endsley, Louis E., Professor Rwy. Mech. Engineering, Chalfonte.
Evans, G. I., M. E., Can. Pac. Ry., Traymore.
Ewing, C. H., Supt., P. & R. Rwy.
Fetner, W. W., Chalfonte.
Foley, M. Y., Boilermaker For., B. & O.
Francis, J. R., Chemist, Big Four, Runnymede.
Freeman, L. D., Draftsman, B. & O., Kenderton.
Frinck, J. R., Pur. Agt., Macon, Dublin & Savannah R. R., Young's.
Gee, A. E., M. Engineer, P. R. R., Wellsboro.
Graham, S. O. S., Con Engineer, N. Y. Central, Traymore.
Haines, F. C., Pur. Agt., Florida East Coast Ry., Dennis.
Haines, W. S., M. M., Erie R. R., Schlitz.
Hankins, F. W., Genl. Foreman, Cumberland Valley, Young's.
Hawkins, Geo., Dennis.
Henderson, H. H., Shop Accn't, W. & L. E. Ry., Mt. Vernon.
Henszey, R. E., Jr., M. E., Traymore.
Hill, J. P., Div. Stk., Penna. R. R.
Holzemer, J. F., Pur. Agt., K. & M., Haddon Hall.
Howaldt, George, Marlborough-Blenheim.
Horsey, A. Southerland, Can. Pac. Ry., Haddon Hall.
Jackson, U. S., Supervisor Track and Line, Atlantic & West Shore Line, Edgewater Hall.
Kase, M. D., Ch. Clk. to M. M., P. & R. Ry., Pennhurst.
Kauffman, G. B., Pass. Agt., Atl. City R. R.
Kelleher, W. J., Pur. Agt., N. O. & N. O. Eastern Ry., Shellburne.
Knight, Charles, Pennhurst.
Knight, William, Pennhurst.
Knotlauch, G. A., P. & R., Pennhurst.
Laizure, L. R., Div. M. M., Erie R. R., Schlitz.
Landon, W. B., Chemist, Erie R. R., Brevort.
Lane, H. O., Draftsman, Southern Ry., Sterling.
Lester, C. E., Genl. Foreman, Erie R. R., Young's.
Lowell, Geo. H., A. M M., L. & N., Lexington.
Lyon, A. N., Gen. Supt., K. & M., Haddon Hall.
McAlister, W., Retired M. M., B. B. & W. R. R.
McElveney, J. A., D. & H., Edgewater.
McKelvey, W. D.,Gen. Fman., P. R. R., Dunlop.
McLean, E., M. M., K. C. Southern, Dennis.
McNoldy, H., For. Mach. Shops, Penn. R. R., Dunlop.
McSweeney, J. F., Foreman, Mt. Clare Shops, Whittle.
Mack, J., Boiler Insp. Public Service, Young's.
Mathias F., Mach Shop Foreman, B. & O., Schlitz.
Metzler, Chas T., Elberon.
Morningstar, E. E., Draftsman, B. & O., Kenderton.
Morton, R. C., Draftsman, B. & O., Kenderton.
Mulroy, R., Genl. Storekeeper, S. & L. & D. F. Lines, Dennis.
Murray, David, Master Painter, Penna. R. R., Pittsburgh, Bouvier.
Nichols, L. T., Gen. Mgr., C. & N. W. R. R., Monticello.
Norris, W. B., Genl. Foreman, Alt. Shops, P. R. R., Dennis.
Norton, A. W., Draftsman, B. & O., Kenderton.
Perrine, Harold, Cent. R. R. of N. J., Pennhurst.
Pfaff, Dr.
Powell, J. H., Trav. Engineer, N. Y. P. & N. R. Ry., Westminster.
Randolph, V. C., Supt. Loco. Operation, Erie R. R., Schlitz.
Reid, W. H., Marlborough-Blenheim.
Rhett, E. M., Elec. Eng., Central of Georgia Ry. Co., Marlborough-Blenheim.
Rodgers, Earl M., Mech. Eng. Office, P. R. R.
Sandman, A. G., Chief Draftsman, B. & O. R. R., Shoreham.
Setchel, F. H., M. E., B. & O. S. W.
Severn, A. B., Draftsman, B. & O., Kenderton.
Singleton, W. T., M. C. B., Flor. East Coast Ry., Windsor.
Smith, C. B., D. & A. Telephone Co.
Sprowl, Lester C., M. M., A. C. L.
Staley, A. E., C. C. & O. Ry., Traymore.
Staley, F. W., C. C. & O. Ry., Traymore.
Stauffer, H. C., Div. Fgt. Agt., P. & R., Young's.
Stewart, W. B., Foreman, B. & O. R. R., Colwin.
Stuart, E. M., P. & R. Ry., Pennhurst.
Swerlev, Richard, Haddon Hall.
Telford, A., Pur. Agt., C. N. & P. T. R. R. of Ga., Marlborough-Blenheim.
Telford. Elliott A., Q. & C., Marlborough-Blenheim.
Umpleby, C. H., Eng., N. Y. C. & H. R., Islesworth.
Van Blaseun, C. B., Gen. For., Chgo. Junction, B. & O., Elberon.
Van Doren. C. E., Central of N. J., Dennis.
Vought, Harry D., Secy., New York & Central Ry. Clubs, Windsor.
Walters, W. H., P. R. R., Continental.
Warthen, H. J., Jr., Wash.-Sou., Sterling.
Webel C. C., Shaftsman, B. & O., Kenderton.
Weidner, O. O., Asst. Supt., P. & R. Rwy.
Whittsitt, W. B., Shaftsman, B. & O., Kenderton.
White, R. H., Eng of Mach., Am. Loc. Co., Traymore.
Wibel, W., Asst. Purchasing Agent, National Ry. of Mexico, Marlborough-Blenheim.
Williams, J. E., Jr., Pur. Agt., Terminal Ry. Asso., Dennis.
Wilson. J. M., P. & R., Elberon.
Wilt, W. L., Chief Clerk, T. W. Temarest; S. M. P., Penna. Lines (West), Dennis.
Wine, W. E., Draftsman, Atlantic Coast Line R. R. Windsor.
Wood, A. L., Associate Prof. R. R. Mech. Eng., Penn. State College. Edison.
Zexcher, F. B., Supt. Augus Shops, C. P. R., Young's.

SUPERHEATED STEAM ON PASSENGER LOCOMOTIVES.

The fact that the maximum capacity of a locomotive is increased when highly superheated steam is used makes the application of superheaters to passenger engines a very attractive proposition. The past year has witnessed a striking advance in this respect. It has been proved conclusively that the increase in equivalent boiler capacity, as a result of using superheated steam for engines in this service, has permitted an augmented tonnage rating and made possible considerably higher average speeds with heavier trains when using engines of aproximately the same weight. The results obtained on the New York Central, Lake Shore and the Chicago & North Western with Pacific type passenger engines equipped with Schmidt superheaters have been entirely satisfactory from this point of view.

The claims of 20 per cent. to 25 per cent. economy for many different varieties of money-saving devices capable of application to steam locomotives have been so common that this figure has seemed to be almost a "standard quantity." When superheaters were first successfully applied abroad figures of this size were prevalent, and much doubt was felt as to whether they could be supported under the conditions in this country. During the past year, however, extensive tests in regular service have shown that this figure has been equaled, and even surpassed, and that coal economies of 30 per cent. to 35 per cent. have been obtained. To this striking economy is to be added the advantages of increased capacity at higher speeds. What this means in favor of superheated steam engines for American conditions is plainly apparent. In this connection the following extract from the Locomotive Superheater Company's catalogue may be of interest:

"The Chicago & North Western has made careful tests of the Pacific type engines with and without superheater.

"The principal dimensions of these two classes of engines are as follows:

Type	Boiler Pressure lbs.	Cylinders in.	Diameter Drivers in.	Weight on Drivers lbs.	Weight of Engine lbs.
4-6-2 Saturated Steam ...	200	23 x 28	75	154,000	247,000
4-6-2 Superheated Steam ..	175	25 x 28	75	154,500	250,500

"The tests included careful records of time, coal, water and drawbar pull for four round trips each of the saturated and superheater engines between Chicago and Elroy, between January 20 and February 4, 1911. Owing to traffic conditions, the trains were two cars heavier going north than coming south, and the grades were also heavier. The main results of the tests are shown below. Attention is called to the increased economy of the engine in the heavier northbound service."

	Saving in per cent. Coal H. P. H.	Water H. P. H.
Northbound	34.9 per cent.	36.7 per cent.
Southbound	26.4 per cent.	32.1 per cent.

A special interdepartmental committee has been called by the Ministry of Ways of Communication to consider the requirements of the Russian State Railway system in respect to new locomotives during the next few years, and also to consider the advisability of replacing the existing relatively weak engines with others of a heavier and more powerful type. The proposition before the commission is to remove during the next ten years all the engines of an old type, amounting to something like three thousand in all, and to replace them with 1,200 locomotives of up-to-date capacity. The proposition is a comprehensive one and should be read along with the important tests that have been made of recent years on the Russian railways with cars of large capacity.

SOME GLIMPSES OF PAST CONVENTIONS.

"Lest we forget" is our excuse for printing the series of pictures (none of which have heretofore been published) that appear in connection with the several instalments of this article. And while on the subject, it will not be amiss to recall some of the events not described by the photographic reproductions.

The early evening of June 18, 1901, found the old band of conspirators, Harry Frost, Hugh Wilson, Bert Waycott, Dan Noble, Jim Hopkins, Fred. Casey, et al, hard at work on the back porch of the Grand Union. They were writing the annual slate—only this time politics was not their sole concern. The conference resulted in the birth of the present splendid business organization of railway supplymen, now on its second ten-year lap.

But what a contrast between the multi-colored, courtyard circus of 1901 and the substantial miniature world's fair of 1911! We wonder what inspired the following, which appeared in the *Daily Railway Age* of June 26, 1901. "The view of the Grand Union court from the upper windows of the main part of the hotel certainly is a pretty picture. It is not the kind of beauty with which Saratoga is most familiar—not the kind that has adorned the ballrooms this week and

On the Veranda of the Grand Union Hotel, Saratoga Springs, 1900.

last, and will be still more numerously in evidence in July and August. Nevertheless, the various pavilions, thick set and contrasting architecture, the shining machinery, the constant flitting of visitors, and above the patches of blue sky peering though the boughs of the noble trees, make a display of modern industrial life in the midst of unusual surroundings, to come into contact with which not even gay Saratoga need blush. Glance at the scene from the windows of the grand stairway, and if you are of a reflective disposition it will appeal to you." If it was written after one of the famous night concerts over which Alex Brown did not preside, no more need be said; but if the words were penned in sober thought, the mystery is indeed deep.

Among the disasters of 1901 were the weather and the loss of Johnnie Chamberlain's umbrella. Of the two, the former was the more serious; but the latter was most heart-rending. It seems that John owned an umbrella which, while neither uncommon in design nor especially fine in texture, was valued highly for its service record. Umbrellas being in great demand, and said service record being clearly indicated by numerous surface markings, the members and guests of the convention were not surprised when a charge

One of the Side Shows, Saratoga, 1901.

John Chamberlain and His Recovered Umbrella, Saratoga, 1902.

J. H. Mitchell and L. H. Turner, Saratoga, 1902.

The Main Circus, Saratoga, 1902.

W. C. Arp and D. F. Crawford, Saratoga, 1902.

En Route to Saratoga, 1903.

of theft was made against a certain second-story man, whose record as a breaker-in at previous conventions had been far from enviable. Some months later the despoiler of John's peace of mind got religion; and when John returned to Saratoga, just one year later, the umbrella, fully recovered, was found in its accustomed resting place in his room.

The 1902 convention passed into history as one of the tamest on record. Even the badger used by the Hodcarriers for their annual initiation failed to show signs of ferocity.

The two principal events of the 1903 gathering at Saratoga were (1) the celebration of the escape of the forces under Generals West, Marden and Blewett from Mackinac island, and (2) the first annual baseball game. For the benefit of those who are still too young at this convention game to be classed as old timers, your executive committee of 1902-03 wended its way to Buffalo, N. Y., early in the winter of 1902, to contribute its share of advice to the joint committee of the M. M. and M. C. B. associations appointed to decide where the 1903 convention should be held. "Everyone" was tired of Saratoga. "They" wanted a change. In due course hotel owners from several well-known resorts were admitted to the meeting room and invited to submit proposals. At the moment we don't recall whether it was the eloquence or the souvenir packs of playing cards, both of which were handed out with equal liberality; but, somehow, the men having to do with the destinies of a certain hostelry located on a prominence in Lake Huron known as Mackinac Island won the day. The news spread. From one end of the land to the other railway men and supplymen alike began to consult maps and gazetteers. After learning the exact location and the proper pronunciation they found that ice and fog had been seen around those parts as late as the middle of June. Next, Dame Rumor awoke. It was whispered that a supplyman had been found who had once visited Mackinac Island and knew that the convention could not be accommodated. The wise ones again consulted their books of reference. "The island is about three miles long and two wide. It is rocky, and covered with trees, shrubs and flowers." Then it must be true. Scott Blewett got some letters—and some telegrams. He also got busy. Finally, a council of war was held at St. Louis, with the result that Mackinac Island was abandoned and Saratoga was again taken by storm.

The other event of 1903 was the first annual baseball game, at Geyser Spring Park. We went in trolley cars, and took the band along to keep folks from going to sleep while the players were at work. When it was all over it was said that the West had won by two runs. The score was 11 to 7.

THE NOMINATION OF A PRESIDENT.

The nominating committee of the Railway Supply Manufacturing Association, consisting of Le Grand Parish, chairman; R. R. Bishop, A. L. Humphry, H. W. Frost, W. J. Schlacks, A. C. Langston and H. M. Pflager, met in the committee room on the pier Wednesday morning and decided on naming B. E. D. Stafford, of the Flannery Bolt Company, Pittsburgh, Pa., as candidate for president, and Samuel G. Allen, of the Franklin Railway Supply Company, N. Y., as candidate for vice-president.

FOREIGN RAILWAY NOTES.

A new law has been submitted by the same ministry asking for the provision during the first half of the year 1912 of rolling stock, rails, fish plates, etc., of a total value of $15,768,000.

A series of new railways has just been carefully considered by the Committee on New Railway Lines in Russia, particularly the following series: Voluinsk (with branch) connecting the station of Zhmerinku on the South Western Railway through Dubno with the station of Cholm on the Privislinsk Railway: length 265 miles with branch from Lyachobtyui to Ozhenia, distance 40 miles.

UNIVERSITY OF ILLINOIS DINNER.

The annual dinner of University of Illinois men attending the conventions will be given at the Shelburne on Saturday evening, at 6 P. M. All University of Illinois men desiring to attend are requested to arrange for reservations with P. G. Stevens, at the booth of the *Railway and Engineering Review.*

STEEL COACHES FOR THE LACKAWANNA.

The Delaware, Lackawanna & Western received in May five 60-ft. steel coaches from the American Car & Foundry Company, New York. These cars are for suburban service and were built at the Berwick shops from the builders' designs. They weigh 100,250 lbs., the body weighing 72,570 lbs., and the trucks 27,680 lbs. The principal members of the underframe are the two 10-in. I-beam center sills extending full length of the car between the buffer beams, and the 6-in. x 6-in. side sill angles; the buffer beams made up of 10-in. channels, and the body end sills built up of 3/16-in. pressed steel diaphragms cut in between the longitudinal members and stiffened by a 6-in. channel passing under the center sills and inclined upward at the end, being riveted to the webs of the diaphragm sheets. The platform arms are 8-in. channels extending to a point back of the bolster. The bolsters are the double type built up of ¼-in. pressed steel diaphragms with heavy top and bottom cover plates. Four cross-bearers transmit the floor loads to the side framing. Two sets of diagonal braces between adjacent cross-bearers are employed to secure rigidity to the underframe. The floor support angles of 2-in. x 1½-in. section are laid with the upper leg horizonal and are riveted by angle connections to the floor beams which consist of 3-in. x 2-in. angles running from center sill to side sill.

The sides of the car are framed in the form of a plate girder, designed to support the entire vertical load of the car without undue deflection. The side sill angle above mentioned constitute the lower flange of the girder and extends in one length from body end sill to body end sill. The belt rail forms the upper flange and the outside sheathing plate the web of the girder. The belt rail is built up of one 5-in. x 4-in. steel angle in one length from corner post to corner post, one 4-in. x ½-in. steel bar riveted to side sheet and one 4-in x 4-in. tee riveted to horizonal leg of 5-in. x 4-in. angle.

The side plates consist of 5-in. x 3-in. rolled steel angles extending in one piece from ramp carline to ramp carline and secured thereto with suitable connections and riveted to side posts, corner posts and letter board. There are ten wide posts on each side of car consisting of 3-in. x 2-in. rolled steel angles in pairs extending from side sill to plate and riveted thereto, and to the side girder sheets, splices and 5-in. x 4-in. belt rail angle. The chipple posts, built of 3-in. x 2-in. rolled steel angles, are provided in the spaces between the wide posts, extending from side sill to belt rail and riveted thereto. The corner posts are built up of two 3-in. x 2-in. angles with 3/16-in. pressed steel cover plate extending around and over the side and end sheets. The door posts consist of 3½-in. x 1¾-side and end sheets. The door posts consist of 3½ in. x 1¾ in. pressed steel channels inserted between end and sill webs and extending to transverse pressed steel channel over door header. The carlines are 1¾-in. x 1¼-in. rolled steel angles placed in pairs over each wide and cripple post. They are bent to

conform to the contour of the roof and run in one continuous length from side plate to side plate. The deck plates are 3-in. x 3-in. rolled steel angles and are attached to each pair of carlines with malleable iron connections. The eaves moulding is a 3/16-in. pressed steel plate. The ramp carline is a 4½-in. x 3-in. rolled steel angle curved to suit the contour of the hood and is securely attached with malleable iron connections to the side plate at each end. Roof sheets are of 1/16-in. rolled steel plates with splices at the carlines. The side girder sheets are 3/16-in. rolled steel plates; the side sheets at ends of the car above the belt rail and the letter board are of ⅛-in. patent level stock, the letter board having inside splices and welded joints. The window frames are pressed from 3/32-in. sheet steel forming the sash guide and also serving as pier covers; the sash rest or belt rail capping is a special section drawn from the same material; the top rail of the frame consists of an ⅛-in. pressed steel plate. The deck sash frames are pressed in one piece from 3/32-in. sheet steel, and are made to accommodate the swinging sash and also the stationary sash at ventilator frames. The step skirting and risers are of ⅛-in. steel plates and the threads are of 3/16-in. plates. The outer edge of step skirting is flared and finished with a drawn brass nosing. The platform plate and step treads are covered with the standard Mason safety tread and outer edges finished with Mason tread in brass. The Standard Coupler Company's buffer attachments are used.

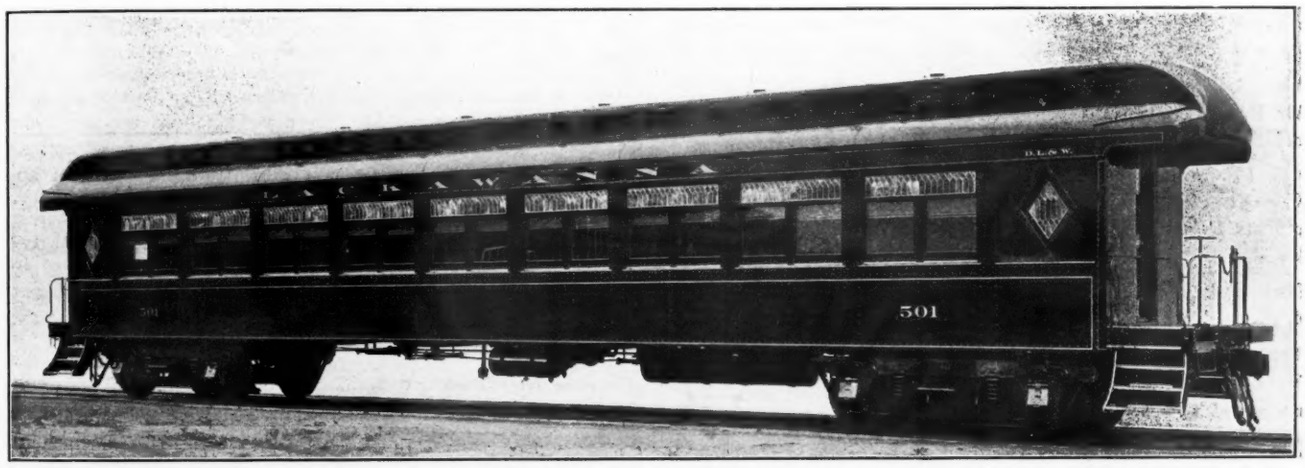
The flooring is an insulated cement floor and consists of galvanized steel sheets buckled downwards between supports to provide space for one layer of 3-ply special Salamander hair felt covered with cloth. One layer of double thickness Resisto insulating materials is then laid. Above this is laid the Keystone section of corrugated flooring resting on and riveted to the floor supporting members, and is covered with the American Car & Foundry Company's standard Acandolith cement flooring to a depth of ⅝-in. above the corrugations. The ceiling is finished with Agasote headlining, 3/16-in. thick in lower deck and ¼-in. thick in upper deck, attached to light wood furrings bolted to carlines. The inside finish is of quartered oak throughout. The wainscoat from floor to sash rest, the inside window stools and stops are of solid oak, while the post panels, deck sash panels, frieze board, saloon bulkhead, stationary seat backs and paneling around the diamond window at end of the car is a built-up 5-ply section with 1/16-in. quartered oak finishing surface. The ornamentation, molding and inlay conforms with the usual practice of the Lackawanna.

The sides and ends of the car are insulated with one layer each of 3-ply Salamander hair felt applied next to outside sheets and double thickness Resisto just back of inside finish. The roof is insulated with two layers of double thickness Resisto applied to underside of roof sheets and just above the headlining. The end doors are metal, and saloon door is quartered oak frame with 5-ply venere panels. All sash are of quartered oak, the lower sash of double windows are glazed with 3/16-in. polished plate glass and the wide upper sash and diamond windows are glazed with leaded art glass.

The car is equipped with 32 Hale-Kilburn Walkover seats with four cross and three longitudinal seats, upholstered in crimson plush and having a seating capacity of 78 passengers. Continuous basket racks with bar bottoms have been applied on each side, and these as well as the window fixtures and all other hardware and trimmings have a dark statuary bronze dull finish. The double windows are provided with Pantasote curtains equipped with the National Lock Washer Company's automatic fixtures. Six automatic ventilators are attached to deck sash on each side of car. The car is lighted by the Commercial Acetylene Company's system and is provided with six Safety Car Heating & Lighting Company's center lamps and one bracket lamp in saloon. The Gold combination direct air vapor system of heating is used. Gould Coupler Company's No. 65 long shank cast steel couplers are used with uncoupling handles. The draft rigging is the Miner tandem with class *G* springs.

The brake system is arranged for high speed brakes with a braking power equal to 90 per cent. of light weight of car with a cylinder pressure of 60 lbs. per sq. in. The car is equipped with the Westinghouse schedule P-1612 brakes, with high speed automatic reducing valves, centrifugal dirt collectors, automatic slack adjusters and train signal. The cars are mounted on 4-wheel trucks, having 8-ft. wheel base, 12-ft. 2-in. length of truck frame, and measuring 3 ft. from the top of the truck frame to the rail. The truck frame, truck bolster and spring plank are cast steel of the Commonwealth Steel Company's design. The axles are the standard M. C. B. with 5-in. 9-in. journals fitted with 36-in. steel tired wheels. The journal boxes are Taylor's malleable iron M. C. B. standard, and Magnus Metal Company's journal bearings are used. Pedestals are cast steel, and the wedges, dropped forged. The equalizers are of 2⅛-in. x 6-in. re-hammered iron. The equalizer springs are 3-coil having 8-in. outside diameter, 10-in. free height and 8¾-in. height under free load of car. The bolster springs are quintriple elliptic 40-in. centers, 6 leaves. The trucks are equipped with the Westinghouse brake beams.

The principal dimensions of the car are as follows: Length over end sills, 60 ft. 7½ in.; length over buffer beams, 66 ft. 11½ in.; center to center of bolsters, 46 ft. 7½ in.; width over side sills, 9 ft. 10⅝ in.; height from bottom of side sill to top of plate, 7 ft. 10½ in.; height from bottom of side sill to top of roof, 10 ft. 9¾ in.



60-Ft. Steel Coach; Delaware, Lackawanna & Western.

Conventionalities.

Stephen C. Mason arrived with the thunderstorm on Tuesday evening.

T. N. Hibbitts, superintendent motive power of the Lehigh Valley, will not get to the convention until to-morrow.

Sterling Campbell is the inventor of a device for reducing noise in hotel dining rooms. It is a noiseless soup spoon.

Staff has discovered that gold teeth can be removed by the freezing process. Ask him to tell you the story. It's rich.

J. F. Deems, general superintendent motive power of the New York Central, motored down from New York with Mrs. Deems.

William Marshall is like a bad penny—he always turns up. Mrs. Marshall is with him and they are staying at the Marlborough-Blenheim.

G. I. Evans, mechanical engineer of the Canadian Pacific, is stopping at the Traymore. Mrs. Evans is with him, this being her first convention.

A number of folks have been asking about the contents of a green cloth bag that George Bryant was carrying under his arm yesterday morning.

W. S. Bartholomew, Western Manager of the Westinghouse Air Brake Company, is at the Traymore. Mrs. Bartholomew and the children are with him.

C. H. Quereau, superintendent electrical equipment of the New York Central, has brought his golf clubs with him, and expects to make good use of them.

John Howard, superintendent motive power of the New York Central, who has not missed a convention for a number of years, will be unable to attend this year.

H. W. Jacobs, assistant superintendent motive power of the Santa Fe, has been delayed in getting to the convention, but has wired that he will arrive this afternoon.

Did you see the flying leap made by Tom Purves and Johnnie Chamberlain, when they broke into the front rank of the M. M. march, as the line was nearing the pier?

Mr. and Mrs. S. D. Anderson, accompanied by Mrs. George Jacoby, of New Orleans, are stopping at the Traymore. This is Mr. Anderson's seventeenth conescutive convention.

C. H. Hogan, assistant superintendent motive power of the New York Central, arrived Tuesday evening. Since the last convention has been promoted and transferred from Depew to Albany, N. Y.

C. E. Chambers, superintendent motive power, Central of New Jersey, certainly enjoys the tri-daily gatherings of a party of seven in the northeast corner of the dining hall, in the Hotel Dennis.

The Mudge family, including Mr. and Mrs. Burton W. Mudge and Burton W. Mudge, Jr., and Mr. and Mrs. Herbert Green, arrived Tuesday afternoon. They are saying at the Brighton.

Fred. Casey is here, greeting his old friends. He is accompanied by Mrs. Casey, who used to attend these conventions regularly, and Miss Casey. They are registered at the Marlborough-Blenheim.

T. S. Lloyd, superintendent motive power of the Delaware, Lackawanna & Western, is just returning from a trip abroad and expects to get to Atlantic City before the convention adjourns.

J. H. Manning, superintendent motive power of the Delaware & Hudson, expects to be down later in the week. He is attending the graduation exercises at Rennselaer Polytechnic Institute where his son is about to be graduated.

J. H. Bracken and H. W. Leeds, although not carrying a bale of "Linofelt" around with them, are here in the interests of their company. Both gentlemen are accompanied by their wives, and are stopping at Haddon Hall.

The two Jays, Keegan and Gardner, are due here on Saturday. As Gardner's aeroplane will carry but one passenger, he has decided to fly from Chicago alone. Keegan will swim down from New York. Both are expected to make record time.

M. H. Haig, mechanical engineer of the Santa Fe, is one of the very few younger men who have nerve enough to take an active part in the discussions on the floor of the convention. More of the young men should follow his good example.

W. L. Kellogg, superintendent motive power and car department of the Cincinnati, Hamilton & Dayton, one of the earnest committeemen of both associations, arrived Tuesday and, with Mrs. Kellogg, is stopping at Haddon Hall.

L. H. Turner, superintendent of motive power of the Pittsburgh & Lake Erie, will not be here this year. We don't know what attraction is keeping him at home, but we have a suspicion that it is his splendid farm near Leavittsburg, Ohio.

George M. Basford arrived yesterday and probably will stay until Friday afternoon. He has a week's boat trip on Lake Champlain planned for the near future, and even the attractions of the conventions can't prevent him from keeping that appointment.

H. S. Hayward, superintendent of motive power of the New Jersey division of the Pennsylvania and president of the New York Railroad Club, is registered at Chalfonte. H. H. Maxfield, master mechanic at Trenton, N. J., is at the same hotel.

George A. Hancock, general superintendent motive power of the St. Louis & San Francisco, arrived Monday evening. One of the seven Mallet locomotives on his road is equipped with a mechanical stoker and is giving good results burning Kansas and Illinois coals.

The Bentleys bid fair to have a long run at the conventions. W. H. Bentley, who was recently appointed to the sales staff of the Standard Steel Works, is attending his first convention, while his father, H. T. Bentley, of the Chicago & Northwestern, has for many years been a familiar figure.

It was during the night of the last thunderstorm. Wilkinson, in walking around the room, disturbed Turner, who asked, "What are you looking for, Billy?" "Nothing," says Billy. "Well," says Jack, "I think you'll find that in the bottle that did have—er—cologne in it."

W. White, well-known in railway mechanical circles on account of his having held important positions with the Pennsylvania, the Illinois Central and the Lake Erie & Western, is here with his wife and son, Stuart White. Mr. White is now president of the National Boiler Washing Company.

J. A. Pilcher, mechanical engineer of the Norfolk & Western, registered yesterday. The report of the tests of the Mallet locomotives made under his direction during the past year has been one of the most important contributions to the data concerning the performance of big locomotives.

J. L. Replogle, assistant to president of the Cambria Steel Company, is here for a day or two only. Mr. Replogle and his wife, and Mrs. McMillen, his mother-in-law, will sail for Europe on the Lusitania on June 21. They will spend some

two months touring through England, France, Germany and Switzerland.

J. F. DeVoy, assistant superintendent motive power of the Chicago, Milwaukee & St. Paul and president of the Western Railway Club, arrived Tuesday and is stopping at the Shelburne. Judging from the session yesterday morning, he has brought his voice with him and is going to see that it is properly exercised.

Although apprenticeship is not down on the program for discussion, C. W. Cross, superintendent of apprentices of the New York Central Lines, is on hand. Two more apprentice schools have been opened by these lines during the year, making 12 in all. The new schools are at Kankakee, Ill., and Gibson, Ind., on the Chicago, Indiana & Southern.

Frederick T. De Long, vice-president of the Chicago Railway Equipment Company, whose son was recently voted by his college mates the most handsome man in his class at Yale, arrived on the Pennsylvania Special Tuesday. Mr. De Long was not accompanied by his son, although father and son are often together and resemble each other in many ways.

Yes, it looks like consolidation. The linotyper man thinks so; at least in setting up the program of the week, printed in yesterday's *Daily*, he credited the M. C. B. Association with the responsibility for the M. M. reception and ball of this week. And yesterday morning Mayor Stoy welcomed the "M. C. B." Association to the city. The two associations cannot withstand the power of the press backed up by the majesty of city government.

A number of bets on the ball game were placed yesterday, at ten to one in favor of the East, by a few insiders who had been "tipped." It seems that in looking over the bats for the Western team brought to Atlantic City by Captain Hammond, it was discovered that one had an imperfection in the form of a knot. As this unfortunate accident will give the Eastern team a decided advantage, it is likely that the odds will not differ much from now on.

That there is more than one "C. & N. W. Ry." is recalled by the M. M. registration list. L. T. Nichols, who registers as "general manager, C. & N. W. Ry.," is general manager, not of the Chicago & Northwestern, but of the Carolina & Northwestern, a road of 133 miles in South Carolina, and his headquarters are at Chester, in that state. Mr. Nichols arrived Tuesday.

Miss Irene Carr, sister of Robert F. and George R. Carr, and Frederick Loyd Baker were married at Oak Park, a suburb of Chicago, on Saturday evening, June 10. The bride, who has attended several of the M. M. and M. C. B. conventions, is well known in Chicago social circles. Mr. Baker, the groom, is a railway man. He is manager of the Empire Freight Line in Cleveland, Ohio. Mr. and Mrs. Baker are now enjoying a wedding trip in Colorado, and on their return will reside in Cleveland.

F. H. Clark attended the conventions last year as president of the Master Car Builders' Association and general superintendent motive power of the Burlington. This year he comes as a past president and with a different railway connection, he having, since the last convention, gone to the Baltimore & Ohio as general superintendent of motive power. He was tempted away from the Burlington by his former chief on that road, Daniel Willard, who is now president of the Baltimore & Ohio. Mr. Clark has seen hard service during the last year; not only in his official position, but in the General Committee on Safety Appliances, which represented the railways of the country in the conferences preceding the adoption by the Interstate Commerce Commission of its safety appliance standards.

The Exhibit.

A large western road has just specified Boss nuts for use as all second nuts in the construction of 500 refrigerator cars to be built by the American Car & Foundry Company.

The United States Radiator Corporation, Dunkirk, N. Y., has just issued a full catalog of its heating apparatus. In addition to detailed information and descriptions of the products of this company, the catalog includes 32 pages of tables and data that are in daily demand by heating engineers..

The Standard Steel Works Company, Philadelphia, Pa., had a lot of fun getting its exhibits installed on Tuesday. Among the products that the concern has brought here to show railway officers is a steel crusher ring which weighs 3,850 lbs., measures 120 in. in diameter (outside) and 9 in. across the face. It took 18 men and some cussing to get the casting into space 9 in the entrance hall.

The J. Rogers Flannery Company, Pittsburgh, Pa., is represented at the convention by B. E. D. Stafford, vice-president; Tom R. Davis, mechanical expert; W. M. Wilson, sales representative for Western territory; Geo. E. Howard, sales representative for Eastern territory; Thomas J. Leahey and Barton H. Grundy, (Commonwealth Supply Company, of Richmond, Va.). sales representatives for the Southeastern territory.

The Cambria Steel Company, Johnstown, Pa., wanted to make an extensive exhibit, but was unable to get space. The following representatives are here, however, ready to answer questions: J. L. Replogle, assistant to president; Ralph V. Sage, steel car engineer; M. G. Baker; W. S. Ottinger, and W. W. Whitney. The company builds steel cars and makes Coffin process axles, wire rods, sheet bars, shapes and plates, and blooms and billets.

The ruby mica lantern globes shown by the Storrs Mica Company, Owego, N. Y., at space 601, are of the standard deep ruby color required for railway hand lamps and are claimed to have the advantage of much greater durability than the glass globes. A further advantage claimed for them is their reliability, which is a matter of considerable importance, as failure of a red hand lantern caused by a broken glass globe is sometimes a mighty serious matter.

The methods of the railway apprentice instruction classes conducted by the railway department of the International Correspondence Schools, of Scranton, Pa., are shown in booth 43 in the main building. W. N. Mitchell, general manager, and other officers of this department are in attendance. With them are apprentices from different railway shops in the United States and Canada, doing the work as it is done in the regular classes in the repair shops. Drawings and class studies are shown.

The Independent Pneumatic Tool Company, Chicago, is showing a complete line of Thor air tools at its exhibit in booths Nos. 576-578. The Thor close-corner drill is of unique construction and compact design. It was placed on the market several years ago by the Independent company. The Thor exhibit also includes center spindle piston air drills, reversible flue rolling, reaming, tapping and woodboring machines, staybolt drivers, riveting, chipping, flue beading hammers and pneumatic grinders.

The T. H. Symington Company, Baltimore, Md., is showing full size models of the Farlow draft rigging in combination with the Westinghouse and the Sessions friction draft gears. One of the principal claims of superiority of Farlow attachments in combination with friction draft gears, over the ordinary attachments, is that the Farlow draft keys positively limit the travel of the friction device within its extreme travel, and distributes excessive shocks in excess of the capacity of

the friction gear to the draft sills at six points through the three draft keys; besides affording more protection to a friction gear than is possible with the riveted yoke attachments. The excess blow is transmitted to the sills in a manner that will prevent their buckling or spreading immediately behind the follower plate stops.

The Chicago Railway Equipment Company presents an unusually attractive exhibit this year in its display of brake beams. The beams are stacked like muskets and the supports are decorated with flags of various nations. A tasteful display of flowers, adds much to the general attractiveness of the display. The Monitor bolster, Creco stack adjuster, Creco journal box and lid, and the new Creco sliding third point brake beam support are also shown. The brass sign of the Creco trade mark harmonizes with the surroundings.

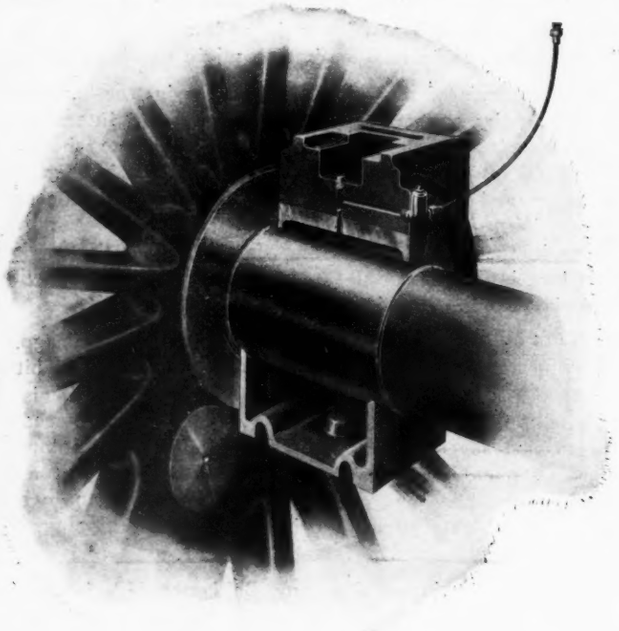
The United States Light & Heating Company, New York, has issued a little folder, Light on Atlantic City, for distribution at the convention. It contains a lot of interesting statistics about Atlantic City and gives lists of all the past presidents of the American Railway Master Mechanics' and Master Car Builders' Associations. All one side of the folder is devoted to a map of Atlantic City, showing the location of the important hotels near the Million Dollar Pier.

CYCLONE VENTILATOR.

The Gold Car Heating & Lighting Company, New York, has on exhibition at its booth, spaces 301 to 311, its cyclone ventilator, which ventilates and excludes cinders, smoke, rain and snow from the car. This ventilator is adaptable for use on refrigerator cars as well as all classes of passenger cars.

DRIVING BOX LUBRICATION.

The system of driving box lubrication advocated by McCord & Company, Chicago, by sealing the top of the driving box, utilizes the cumulative pressure generated by the revolving journal in the cavity in the crown of the brass to separate



McCord System for Lubricating Driving Boxes.

the bearing surfaces of the journal and the brass. In addition, by pumping a film of engine oil through this cavity into the bearing, the journal is run like a floating bearing. Engine oil, on account of its adhesive and cohesive qualities, is a good lubricant for driving journals. There is a growing tendency to return to engine oil as a driving box lubricant. The McCord system provides a positive method of delivering the oil to the driving box. The cost of driving box lubrication with a force feed of engine oil is claimed to be as low as with any other lubricant, and a saving is made in the reduced wear of journals and brasses, in addition to reducing the internal friction of the locomotive, which decreases the coal consumption. An instance is cited wherein the wear on driving journals, after 100,000 miles run, could not be measured with a micrometer.

MOTORS FOR RAILWAY SHOP DRIVE.

The motors shown herewith are made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., being designed for railway shop drive. They are made in a wide variety of styles, characteristics, and speeds so that proper applications can always be made. The type S direct-current motors

Westinghouse Motor for Shop Drive.

are used for machine tool work. They can be obtained for constant speed, varying speed, or adjustable speed service, and are made shunt, compound, or series wound according to the service for which they are intended. Special modifications are made for hoisting and for operating bending rolls. The direct-current crane motors are compact and develop a high torque. For alternating-current circuits, the Westinghouse motors are made in four types: Type CCL, with squirrel cage rotors, for general constant speed work, as in operating wood-working

Westinghouse Motor for Belt Drive.

machines; type MS, with squirrel cage rotors, for severe constant speed service; type HF slip ring motors for constant speed service where high starting torque and low starting current are necessary; and type MW, slip ring motors, which are used for severe intermittent, varying speed services, such as operating cranes, hoists, elevators, etc.

DETROIT TRANSFER FILLER.

The Detroit transfer filler, made by the Detroit Lubricator Company, Detroit, Mich., consists of a reservoir of about three pints' capacity with two valves, one near the bottom controlling the admission of water and the other at the top on the opposite side controlling the oil exit. Although both connections are at the top, the water is conducted through a passage drilled in the wall to the bottom of the transfer filler before being released. A filler plug is provided at the top and a drain cock at the bottom, and a gage glass shows when all the oil has left the transfer filler. This transfer filler allows the lubricator to be filled at any time, regardless of whether the locomotive is working under steam, drifting or at rest. All that is necessary is to open the water inlet and oil outlet valves. Immediately, the water which has replaced the oil in the oil reservoir of the lubricator and the oil in the transfer filler change places. There is no necessity of shutting off the boiler pressure or closing the water valve and feeds. Frequently the location of the lubricator and the presence of cut valve seats have made methods of filling a lubricator wasteful and bothersome processes. The Detroit transfer filler is constructed with the idea of eliminating delay, trouble and waste in refilling the lubricator. It may be attached to any lubricator.

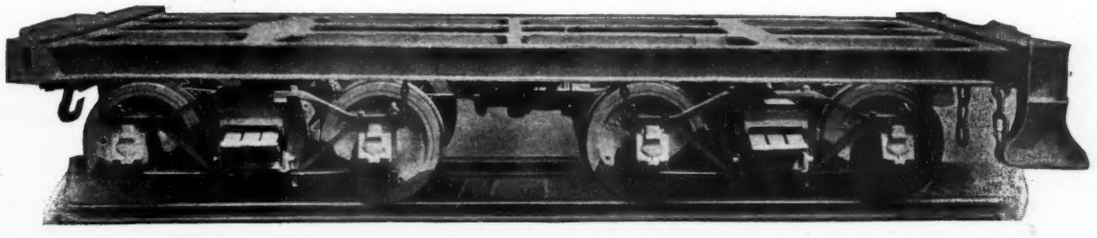
MANUFACTURE OF BETTENDORF BOLSTERS.

The bolsters shown in the accompanying illustration are made by the Bettendorf Axle Company, Davenport, Iowa. They are built of commercial I-beams to which are riveted steel cover plates, malleable iron side bearings, column guides and center plates. The I-beam flanges are punched, full length of the bolster, by one stroke of a hydraulic press. The webs of the beams are then pressed or corrugated to reduce the ends for proper clearance over, and free entrance into the truck frames. After shaping the beams the webs are punched for train pipe holes and king bolt bearings. The king bolt bearings are then riveted in position and the beams are ready to receive the cover plates, side bearings, center plates and column guides, which are riveted in position on hydraulic riveting machines. Truing the bolsters is the next operation, which is performed in an hydraulic press especially designed for this purpose. In this operation the proper relation between the center plates and side bearings, side bearing and spring seats, and distance over column guides is obtained. and the bolster is then ready for inspection. The I-beams are corrugated to permit the ends to clear and enter any design of truck frame, and are shaped cold in hydraulic presses to prevent forging stresses. Commercial rolled beams are used in order to obtain maximum strength with minimum weight. The points in favor of these bolsters, built of commercial sections, are that they are strong, that they possess no superfluous metal, and that their ability to carry the load is independent of workmanship.

Bettendorf Bolsters.

COMMONWEALTH CAST STEEL TENDER FRAME.

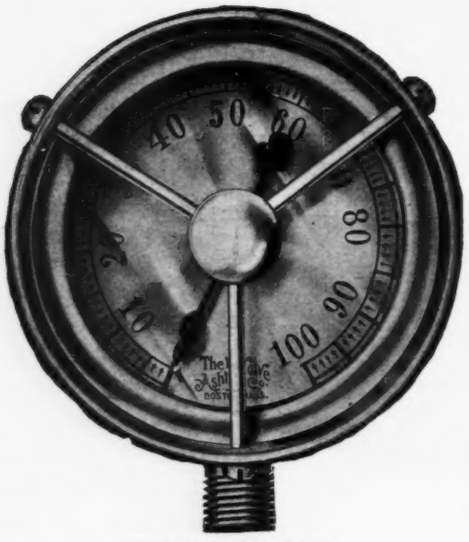
The Commonwealth Steel Company, St. Louis, Mo., booth 313, enlarged the field for steel castings when it brought out the one-piece locomotive tender frame several years ago. This casting is a splendid contribution to the steel founder's art, and its adoption has steadily increased on account of its great strength and simplicity of construction. The protection and firm foundation afforded the cistern, and the facility for securing proper distribution of metal and its non-corrosive qualities, have also contributed largely toward its success. The Commonwealth Steel Company claims that it far surpasses in strength and durability any type of built-up construction.



Commonwealth Tender Frame.

PROTECTED AIR GAGE.

The accompanying illustration shows a protected air gage made by the Ashton Valve Company, Boston, Mass. It has been devised to meet the requirements of a practical gage for use in conjunction with the common rear-end train brake cock. With such a gage, rear-end train brakemen having in charge the backing of trains can know at a glance the exact pressure on the brake system, assuring confidence of perfect control. The protected face of the gage makes the instrument durable and entirely suitable for such service. The glass and dial are set considerably below the protecting bars. Therefore small projections on the railings of cars, such as lugs or bolts, which would break the glass and do other damage, are prevented from penetrating this gage. The crossbars may be struck with sufficient force to bend



Protected Air Gage.

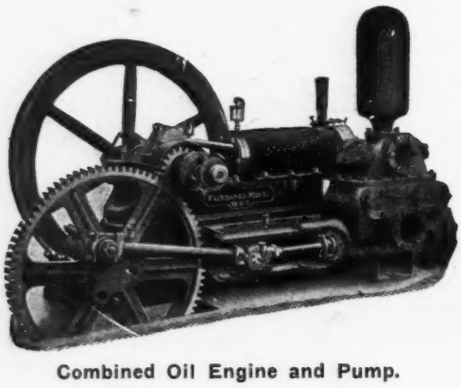
them without affecting the glass, and should they finally require replacing it can be done at slight expense.

ABOUT VALVE MODELS.

The custom at conventions is to show models which are 1-4, 1-6 or 1-8th size. With this great reduction in the size of all of the parts of a machine it is very difficult to show detail construction, and if the makers of the machine are trying to show advantages in construction the lesson of the model is largely lost. Furthermore, if the machine is such a device as a valve gear and is intended to show valve events, the inaccuracies of construction in the model are apt to produce different valve events than what would be obtained on a full sized gear. Even though the model might exactly reproduce the valve events, it is very hard to catch the valve at cut-off, release, etc., without the aid of a magnifying glass. For these reasons the display of a reduced size valve gear has not been attempted this year by the Pilliod Company, New York. Instead, it has one of its stock gears mounted on a frame under the same conditions that it put up on the locomotive. This is full size, and will show just what valve events the gear is capable of producing.

OIL ENGINE FOR FEED WATER PUMP.

Fairbanks, Morse & Company, Chicago, has put on the market an oil engine connected to a pump for supplying water to locomotive water stations. The oil used is a distillate from crude oil, being purchased at a price varying from three to six cents per gallon. This is seven to nine cents cheaper than gasolene, which has been the customary fuel. The Illinois Central is using this arrangement at one of its water stations.

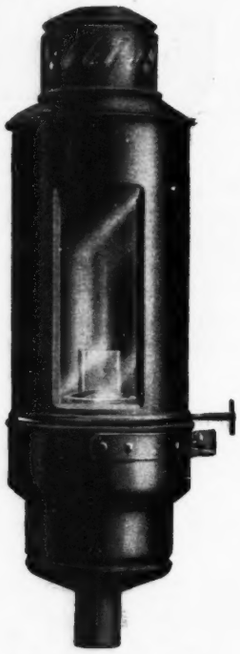


Combined Oil Engine and Pump.

ADLAKE LAMPS.

Among the lamps exhibited by the Adams & Westlake Company, Chicago, are the Adlake small train indicating lamp and the new gage lamps Nos. 17 and 18.

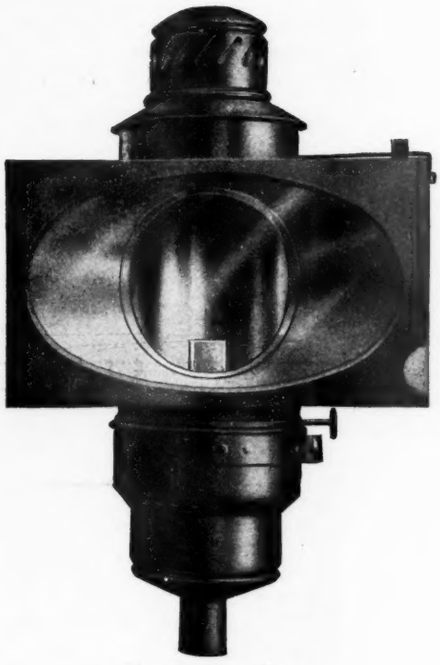
The train indicating lamp is claimed to facilitate train movement by insuring more accurate handling of orders. A glance reveals the number of the train to the operator, passing engine or train crew, from any position in front of the engine or beside it, or from the front or rear of caboose on freight trains. It saves confusion by making it unnecessary to remember two numbers—that of the engine and that of the train—as is the case heretofore when the engine number is the indirect index to the train number, necessitating frequent comparison. The engine numbers displayed from the side of the headlight are often obscured, making quick reading of identification numbers difficult, and can only be read from a position directly opposite. The indicating lamp identifies the train before or at the time



Water Gage Lamp.

Adlake Train Indicating Lamp.

the engine passes, as well as from the rear, an obvious advantage. The gage lamps, Nos. 17 and 18, have interchangeable parts and are equipped with an outside wick regulator. With this outside wick regulator the maximum of illumination should always be obtained, because the broad side of the flame is always toward the glass.

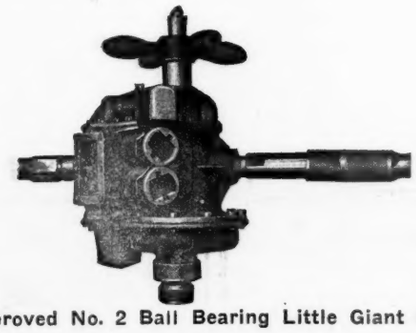


Steam Gage Lamp.

The lamps are simple in operation. All parts are interchangeable except those containing the glass-holder. The glass is removable and is held in place by a retaining spring and no soldering is required. The lower part of the body is made of heavy pressed sheet steel, reinforced by a malleable iron bottom. They have nickel-plated reflectors, removable oil pots and take No. 1 ratchet burners.

BALL BEARING LITTLE GIANT DRILLS.

The accompanying illustration shows the new improved No. 2 ball bearing Little Giant drill, recently introduced by the Chicago Pneumatic Tool Company, Chicago, which will be found in the company's exhibit. This drill is the same in



Improved No. 2 Ball Bearing Little Giant Drill.

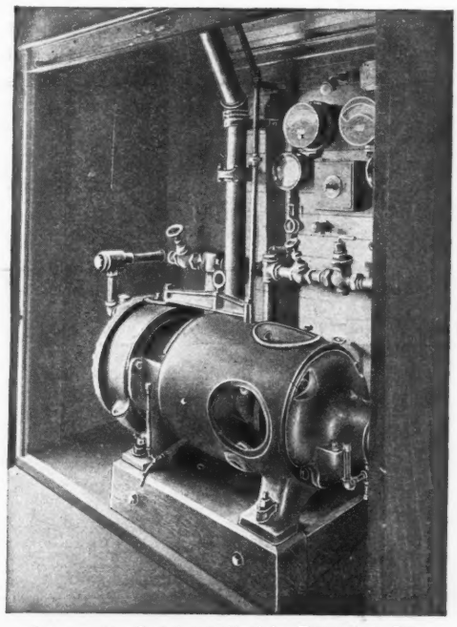
general appearance as the company's C drill. It has the same diameter and stroke of piston, the same diameter of valves and areas of ports. With the exception of the pistons and valves, all other moving parts are made heavier and stronger. On account of ball bearings of a new type, it will operate at light pressures. The friction of this machine is so small that the spindle may be rotated by simply blowing into the air handle. Although this tool has been tested with a 2-inch drill, drilling at the rate of ⅝ in. per minute in hammered steel, the makers rate it for a 1¼-in. drill. When used for this work, the makers claim it cannot be stalled, but will work up to the limit of a high speed twist drill.

THE FIRST CONVENTION AEROPLANE.

The convention of the M. M. and M. C. B. associations have seen a great many new and novel things. The railway supply manufacturers are often original and resourceful, but it has remained for C. H. Williams, Jr., representative of the Creco brake beam, to be the first man to attempt to bring an aeroplane to these conventions, and he is going to do this with the help of the *Railway Age Gazette*. The arrival of the Creco aeroplane is slated for Saturday morning. A telephone message from our New York office, received just as we were going to press, indicates that the Creco aeroplane will be ready to leave New York some time during Thursday night. It should be sighted over the Million Dollar Pier early Friday morning. Like the Creco brake beam, it can be depended upon for night or day travel.

CURTIS TURBINES FOR TRAIN LIGHTING.

Curtis turbo generator sets, made by the General Electric Company, Schenectady, N. Y., installed on a locomotive or in a baggage car, as shown in the illustrations, meet the demands of train lighting service. These sets consist of a Curtis turbine direct connected to an electric generator, and form compact, sturdy units, simple in construction and requiring little attention. The operation of the train lighting set involves only the opening of a steam valve when it is desired

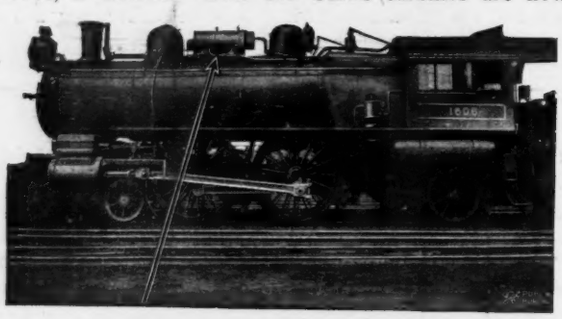


Generator Set Installed in Baggage Car.

to put the turbine in operation, and closing the valve to shut it down. Each car is illuminated with a steady light which is of good quality, due to the voltage regulation of the turbine. This service permits the use of electric cooking and heating utensils in buffet and sleeping cars, and of electric toilet articles in drawing and sleeping cars.

For suburban service, no auxiliary equipment is required, and the Curtis turbine affords a simple and economical equipment, dispensing with battery boosters and regulators. Electricity is furnished for lighting the whole train, including

passenger compartments, toilet rooms, and platforms of passenger cars, interior of baggage cars, cab of locomotive and portables, if desired. Over 300 Curtis turbines are now in



Turbo-Generator Applied to Locomotive.

use on such railways as the Chicago, Burlington & Quincy, the Great Northern, the Northern Pacific, the Union Pacific, the Chicago, Milwaukee & St. Paul, and also on many smaller roads.

DAVIS CAST STEEL WHEELS.

The Davis cast steel wheel is included in the exhibit of the American Steel Foundries, Chicago. The process of making these wheels was invented by J. C. Davis, assistant to the first vice-president of this company, who introduced ferro-manganese into a stream of molten steel as it passed from the ladle to the mold, making a cast steel wheel which has a hard, tough manganese tread and flange, with a plate and hub of ordinary soft steel. To accomplish this result, the wheel is cast in a mold which is caused to revolve during the pouring period. The first of the metal to enter the mold is treated with the ferro-manganese and is followed, without interruption, by ordinary soft steel. The manganese being much heavier than steel, is thrown by centrifugal force to the outer parts of the mold, where it is absorbed in the steel, while the soft steel remains in the center, forming the plate and hub. As manganese steel is one of the hardest and toughest metals known, with great ability to resist shocks and blows, it is a valuable material for the wearing surfaces of the wheel.

As the Davis wheel is a one-wear wheel it is not necessary to remove it from service several times during its life to be turned, in order to secure its full mileage. This feature avoids delays to equipment when the wheels are being changed and avoids the expense of handling and the cost of turning which is necessary before the wheel can be returned to service. Davis wheels before shipment are rough bored to within ⅛ in. of the finished size and are also ground on the tread and throat of the flange. The wheels are ground not only to make them as truly circular as possible, but to

Davis Cast Steel Wheel.

give them a polished surface and general accuracy which reduces to a minimum the chances of uneven wear after the wheels go into service.

The makers claim that Davis wheels in heavy engine tender service are averaging about 30,000 miles per 1/16 in. of wear; that the flange is about four times as strong as the flange of a cast iron wheel, thus eliminating the danger of broken flanges; and that on account of the strength of the metal used in the manufacture of these wheels it has been possible to reduce the weight of the standard 33-in. wheel to about 600 lbs. each, showing a saving in weight of 1,000 lbs. per car when compared with cast iron wheels for 50-ton equipment, and more than this amount when compared with steel tired or solid rolled steel wheels.

Pouring Davis Cast Steel Wheels.